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CONTENTS.

ILLUSTRATED ARTICLES:	PAGE.
The Paiste Incandescent Switch	274
A Condenser System of Electrical Distribution	274
The "Lungen" Bell	274
Baxter Motors of Large Horse-Power	275
The San Jose, Cal., Electric Road	275
The Colburn Arc and Incandescent System	277
The Abdank Magnetic Call and Integraph	279
The Geyer-Bristol Meter for Direct and Alternating Currents	280
NEW BOOKS:	
"L'Accumulateur Employé Comme Transformateur-Distributeur"	274
"Diamagnetism and Magne-Crystallic Action"	274
"The Steam Boiler Catechism"	274
CORRESPONDENCE:	
Simultaneous Telegraphy and Telephony in America	276
The Quadruplex Controversy	276
EDITORIAL:	
Paragraphs	273
MISCELLANEOUS:	
Sudden Death of Mrs. W. J. Johnston	273
The National Electric Light Association	273

MISCELLANEOUS:	PAGE.
A Report on Execution by Electricity	275
Meeting of the New York Subway Board	276
The Management of Accumulators	277
Meeting of the American Institute of Electrical Engineers	277
Heavy Snow on an Electric Road	277
Peculiar Rotary Motions Found in Lightning and other Electrical Currents	278
Decision against the American Bell Telephone Company	278
Some New Thomson-Houston Electric Roads	279
The Electric Road in St. Catherine's, Can	280
SPECIAL CORRESPONDENCE:	
New York Notes	281
New England Notes	281
Philadelphia Notes	282
Western Notes	282
Canadian Notes	283
English Notes	283
DEPARTMENTS:	
The Telegraph	283
The Telephone	283
The Electric Light	283
Applications of Power	283
Personals	283
Miscellaneous Notes	284
Business Notices	284
Our Illustrated Record of Electrical Patents	284

Forms of Lightning Discharge.

THE paper of Dr. Parker, read before the Electric Club, draws attention to a singular quality with regard to lightning discharge, and one which has recently been made a particular study in connection with this natural phenomenon. A recent meeting of the Royal Meteorological Society of London was specially devoted to this subject, and we may say that the entire work accomplished in this direction is due, almost without exception, to the employment of photography. Without this valuable aid, it would hardly be possible to prosecute these studies at all. But, as has been shown, a number of precautions are necessary to avoid the obtaining of false pictures, due to the vibration of the camera, or to the illusory optical effects due to the instrument, and which appear in the photographs. The spiral motion frequently observed in lightning discharges is particularly dwelt on by Dr. Parker, and the cause thereof is still a matter of conjecture.

Condensers as Transformers.

FROM time to time we have had occasion to call attention to various kinds of transformers based on the principle of electro-magnetic induction, but inventors, not content with exploiting in this particular direction, have struck out into new paths, and sought for transformers of widely different types. Among the new ideas, the employment of the old static condenser as an accumulator and reducer of potential has of late received attention. In another column we describe a system in which this apparatus is combined with, and made an integral part of, a system of distribution by means of the alternating current. The principle of reduction here adopted, it will be noted, consists in varying the relative areas of the condenser in proportion to the reduction of potential desired, just as is the case with the electro-magnetic converters in which the number of turns of the primary and secondary are made to vary in proportion to the reduction of potential aimed at.

The Telephone Decisions.

WE give elsewhere in our columns a synopsis of the decision rendered by Justice Miller in the United States Supreme Court last week, overruling the decision of the Circuit Court of Massachusetts, and remanding the Government's telephone case to that court for a hearing on its merits. It will, we think, come rather as a surprise and shock to inventors and patentees to know that, after all, their patents are liable to be attacked whenever the powers of the Government may happen to fall into unscrupulous hands; but the occasions of attack are likely to be so rare that there need not be the slightest alarm. The discredit that has fallen upon Mr. Cleveland's otherwise clean administration, from the Garland scandal, will serve as a warning for many years to come, whatever be the party in office. As to the effect of this remand, we can only express our firm conviction that it will be utterly insignificant. So far as we can discover, not a single new issue of a nature bearing directly on the validity of the Bell patents is to be raised, or can be. The Supreme Court has itself established the patents and vindicated Prof. Bell, and we see no gain to the public or to individuals from a prolongation of the government case. It would be better to have the whole dirty business wound up and put out of sight.

The American Institute of Electrical Engineers.

THE Institute is continuing its good work, and the large attendance at its meetings is indicative of the interest taken by the members in the work. The last one, of which we give a more detailed account on another page, presented several matters of interest, including a paper on the Geyer-Bristol meter, which elicited considerable discussion. This particular subject is likely to receive much attention at the next meeting, for which the paper announced will be by Mr. W. J. Jenks, director of the Edison Standardizing Bureau, entitled "Six Years' Experience with the Edison Meter." We shall probably be treated to a thorough ventilation of this subject from all points of view, and some valuable information may be expected, both from the paper and the discussion. Meters are a leading question of the day. Another interesting subject brought before the last meeting was the integraph of M. Abdank-Abakanowicz, who showed the various applications to which this instrument could be put in the solution of electrical and magnetic problems in connection with the construction of electrical machinery. This instrument is certainly a marvel of ingenuity and elaborate research, and we shall probably hear more of its use. Not the least interesting part of the meeting was the exhibition of the instrument for electrically recording and reproducing the performance of a piano player, which may or may not go far toward the spread of good music, and which, in the melographic form, is certainly an admirable device to enable great composers to record their improvisations as well as other creative work.

English and American Practice.

WHILE the practice in the operation of the continuous current distribution of incandescent lighting has been tolerably uniform in this country and abroad, it would seem that, so far as the alternating system of distribution is concerned, considerable diversity exists at the present time in respect to the potential of the primary current. The primary currents in use in America have to a large extent been distributed at 1,000 volts pressure and reduced for the lamp circuits to 50 volts. We have also noted the introduction of what is known as the compensator system, which, with a primary current of 330 volts potential, is divided into three parts, as it were, furnishing 110 volts to each individual lamp circuit. Thus, while we have not exceeded 1,000 volts to any appreciable extent, voltages far in excess of this are favored abroad at the present day, and the near future will see even still greater potentials employed. Thus, in one system of distribution employed, a potential of 2,500 volts is used, and we are now informed that no less than 10,000 volts is the potential adopted for the large central station in course of construction at Deptford in England, which is to supply light for the city of London. The main conductors employed in this station are to consist of a tube for one side of the circuit, within which, and insulated from it, is a solid conductor constituting the other side. We must admit that we await the complete operation of this installation with some degree of expectation. The potential chosen is so much in excess of what has heretofore been attempted in underground work that the success of the undertaking ought to settle very decidedly the vexatious question with which our subway boards in our various cities are grappling.

Gas and the Electric Light.

THE relations between gas and the electric light came in for consideration at the recent Toronto meeting of the American Gas Light Association, in the address of the president, Mr. T. Turner, of Charleston, S. C. While admitting that the electric light had many advantages, and had done much to increase the general demand for a higher standard of illumination, to the direct benefit of gas producers, Mr. Turner was of the opinion that it was best for the two interests to stand apart. The attempt to combine them he spoke of as "the questionable policy of endeavoring to monopolize the entire business of supplying artificial light," and he said further: "I cannot see why gas companies should engage in the electric lighting business any more than they do in the kerosene oil and candle business, simply because kerosene oil and candles furnish artificial light." There might be exceptional circumstances favoring consolidation, but he doubted the ability of any one man to handle businesses so dissimilar, and with one of which he was likely to be ill acquainted. Mr. Turner therefore recommended that gas engineers should bend their energies to the development of the possibilities of their own business. We have no reason to doubt that Mr. Turner voices the sentiments of a large number of gas men, but it is evident from the extent to which gas companies have bought, or been bought up by, electric light companies, and the rapid increase in the number of combination gas and electric light plants, that there is a body by no means small of those who believe that to supply electric light is the right policy to pursue. Mr. Turner allowed in so many words that this sentiment was warmly advocated, and it simply remains to be seen which opinion will carry the day.

SUDDEN DEATH OF MRS. W. J. JOHNSTON.

The readers of THE ELECTRICAL WORLD will, we are sure, be pained to learn that a great calamity has befallen the publisher of this journal in the sudden and unlooked for death of his wife, which occurred at the family residence, "Annandale," Greenwich, Conn., on Friday, Nov. 16. Only those who are acquainted with Mr. Johnston in his home relations, and who have known his late wife and how devotedly attached each was to the other, can appreciate the magnitude of the bereavement which has visited him and his family of five very young children.

Mrs. Johnston, who was only thirty years of age, was of a bright, sunshiny disposition, and scarcely knew what it was to be ill. On the evening of Thursday, Nov. 8, however, alarming symptoms manifested themselves. They came on suddenly and wholly unexpectedly, arising apparently in a moment, and without the slightest warning. Inflammation of the brain set in, accompanied by a high fever, and the patient rapidly grew worse. The regular family physician was reinforced by three consulting physicians, and everything that medical skill could do was done to combat the disease. For several days it was thought that good progress was being made, and no thoughts of a fatal termination were entertained, but at five o'clock on the morning of Friday, Nov. 16, a sudden change for the worse took place. The doctor, who had remained at the house all night, summoned the members of the family to the bedside fearing that the end was approaching. These alarming symptoms, however, gradually wore off, though the condition of the patient remained critical all day. At half-past six the same evening, Mrs. Johnston's robust constitution and great will-power succumbed, and she quietly passed away. A short funeral service was held at the house on Tuesday, Nov. 20, at 1 P. M., followed by service at the Greenwich Congregational Church at 1.30. The interment took place immediately afterwards at the new Putnam Cemetery, Greenwich.

National Electric Light Association.

A meeting of the Executive Committee of the National Electric Light Association was held in Pittsburgh, on Monday last, Nov 19. A special dispatch received as we go to press informs us that Messrs. Duncan, Morrison, Kreidler, Smith, Sunny, Garratt and Harding were present. The resolution passed at an irregular meeting of the committee in New York regarding selection of permanent quarters and a secretary was voted illegal and declared void.

Mr. Harding then resigned as secretary, and Mr. Garratt was elected in his place to serve until the Chicago meeting. Mr. Sunny, chairman of the Executive Committee, was empowered to engage a large hall for exhibition purposes.

Exhibitors will receive due notice from the secretary. The date of the Chicago meeting has been fixed for Feb. 19, 20 and 21.

NEW BOOKS.

L'ACCUMULATEUR EMPLOYE COMME TRANSFORMATEUR-DISTRIBUTEUR A COURANTS CONTINUS DANS LES STATIONS CENTRALES ELECTRIQUES. By B. de Montaud. Paris, 1888. Paper, 7 × 10 in.; 44 pp. Price, $0.80.

The author is the well-known constructor of storage batteries and has from the start adhered to the Planté type of cell, claiming for it a durability not possessed by others. In the present pamphlet the accumulator has been treated as a means of transforming and distributing currents from central stations, and in addition its qualities as a regulator have been gone into quite thoroughly. The pamphlet is illustrated by a number of diagrams showing the various methods of combining batteries to obtain different results for distribution at different pressures with a given number of cells.

DIAMAGNETISM AND MAGNE-CRYSTALLIC ACTION. By John Tyndall. Second Edition. New York. D. Appleton & Co. 1888. 5 × 8 in.; 288 pp. Price $1.50.

This work is too well known to require a review at our hands; but the appearance of a second edition is noteworthy and timely, now that electrical phenomena in relation to the

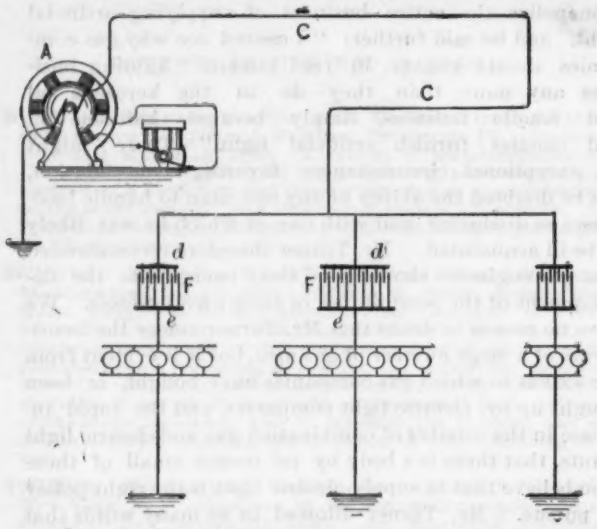


FIG. 1.—THE MCELROY CONDENSER SYSTEM.

electro-magnetic theory of light are becoming better understood. The new edition has been rendered somewhat more compact by the omission of various topics which were introduced in the first edition, but the contents remain otherwise essentially the same as before.

THE STEAM BOILER CATECHISM. By Robert Grimshaw, M.E.. New York. Practical Publishing Company, 1888. 4 × 6 in.; 402 pp. Price, $2.

Mr. Grimshaw's catechisms on the steam engine, the pump, etc., have received a valuable addition in the present work in which the steam boiler is taken up and discussed by query and answer in a most thorough and painstaking manner. Every point pertaining to the steam boiler and its connections is thoroughly brought out, and the book is full of practical hints and suggestions. In the hands of the boiler attendant of the electric light station, it cannot fail to be of the utmost value, both as regards the economy in fuel, which it may bring about by more intelligent handling on the part of the fireman, and by the reduction in repairs through a more intimate knowledge of the construction of the boiler and the things to be avoided in its management. The book is well illustrated and is provided with a very full index.

The Paiste Incandescent Switch.

We illustrate in the accompanying engravings a novel switch or cut-out for incandescent work, designed by Mr. H. T. Paiste, of Philadelphia, Pa. Practical workers in incandescent wiring will appreciate the efforts of the designer in attempting to avoid the use of spring brass for electrical contact, experience having demonstrated that the contact, unless soldered, will, in time, through corrosion or dust, be heated, removing the temper from the brass, and thereby destroying electrical contact. As shown in the illustrations, the entire switch is stamped from sheet (not spring) brass by standard dies, making all parts interchangeable.

The parts of the switch, Fig. 1, consist of seven pieces, viz.: the U-shaped main shell, side plate, two arms, spindle, spring, and hard rubber handle. The spring is attached to the ends of two arms and is extended when the switch

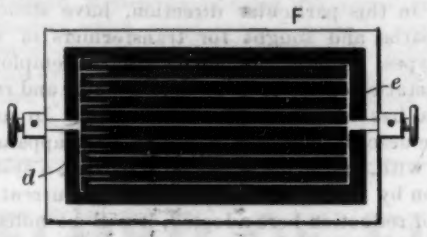


FIG. 2.—THE MCELROY CONDENSER SYSTEM.

is being operated to make or break circuit. As soon as this is accomplished, the spring is no longer under tension. The circuit wires are attached to binding screws on the U-shaped main shell and side plate. The arm, as shown in Fig. 1, completes the circuit, between the side plate and the main shell, at its point, and through the spindle, upon which it is centered, making ample electrical contact. In breaking the circuit, the handle which is attached to the spindle turns to the right, moving the arm up the side plate, preserving sufficient electrical contact at its point until the position shown in Fig. 2 is reached; then the spring which joins the ends of the arms, being lengthened as the arm climbs the side plate, throws the same rapidly to the position shown in Fig. 3, instantly breaking the circuit. Whatever arcing might result would be on the back of the arm, and not on the face, where electrical contact is made. The making of the circuit is accomplished in like manner by the second arm.

Mr. Paiste has given this switch a thorough test of twelve months at the sea shore and at sulphur springs, where corrosion destroys many switches. The reports from these places have been most satisfactory, not a switch having been destroyed. The switch has also been adopted by a number of central stations.

A Condenser System of Electric Distribution.

The use of the condenser as a transformer of energy has already been pointed out, and its possible use in a system of current distribution suggested. In a patent recently issued to Mr. Wm. J. McElroy, of Pittsburgh, Pa., the inventor describes such a system, in which the condenser plays the part of the converter in an alternating current distribution.

The action of the condenser is too well known to require any detailed account here, and it suffices to say that the inventor claims that if a condenser be introduced into the circuit of an alternating current generator, the rapid reversal of direct charges on one set of plates will be attended with an equally rapid reversal of induced charges on the other set, and the current in all parts of the circuit will continue as before the introduction of the condenser, notwithstanding the fact that there is no electrical contact between the two sides of the condenser and that no flow of current can take place through it in the ordinary sense of the word. The electromotive force of the current will be unchanged by the introduction of the condenser in the circuit; but, according to the inventor, the current strength may be materially altered, for, whereas before the introduction of the condenser, the current strength was regulated by Ohm's well-known law, after such changes it will be found to depend on the electromotive force of the generator and the capacities of the condensers—their joint capacities if connected in multiple—and the reciprocal or the sum of the reciprocals of their several capacities if arranged in cascade or series.

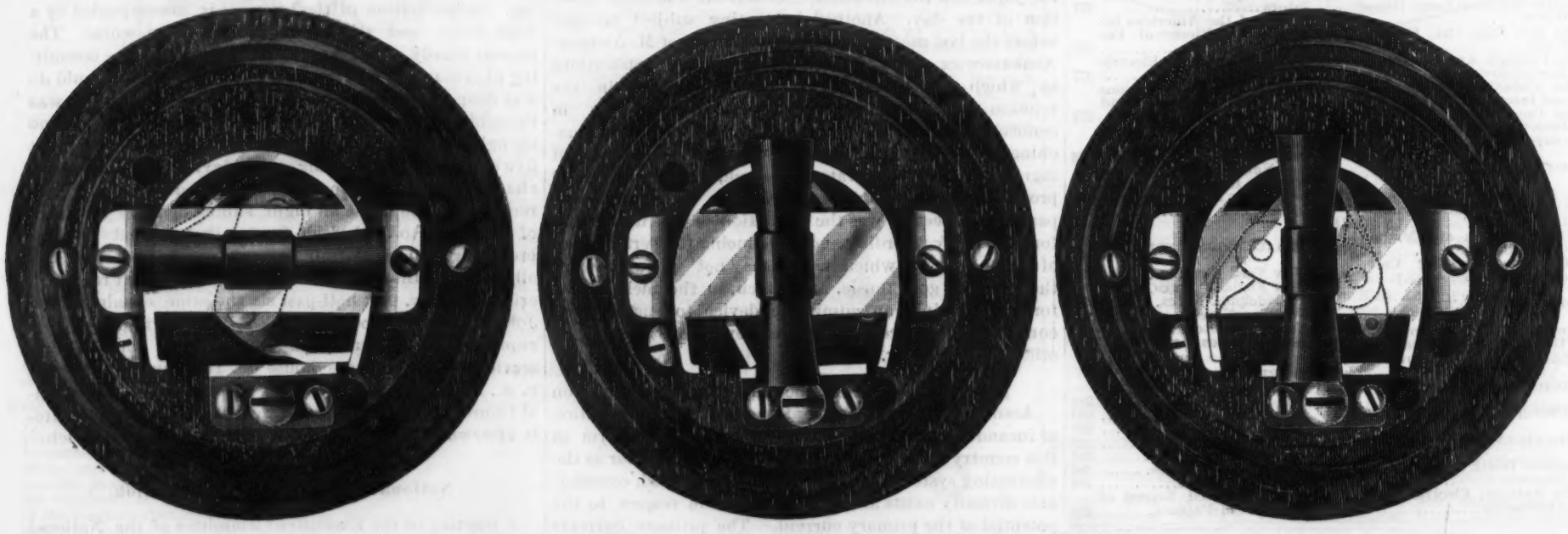
The accompanying engraving, Fig. 1, shows the arrangement of the system, and Fig. 2 illustrates the type of condenser employed. The operation of the system is quite simple. If it be desired to carry on the main line a current of one thousand volts and to supply current on the consumption lines at one hundred volts, then the size of the condenser sheets at one side must be to those at the other side as one to ten; the smaller sheets *d*, being connected to the main line are charged at each pulsation of the generator to five hundred volts on either side of the zero line. From these smaller sheets charged to this high potential induced charges will be received by the larger sheets *e*, or rather by those portions of them immediately opposite the smaller sheets, these induced charges being probably of the same initial potential as that shown by the small sheets; but at the instant of reversal of the main current, and just as it swings past the zero-line, the induced charge, being no longer bound by the electrical attraction of the smaller sheet, is free to flow over a surface ten times larger than that which originally held it, the potential falls to one-tenth the original figure, and the electromotive force at which it can be drawn from this end of the condenser will be correspondingly reduced below that of the inducing current.

As will be seen, the main line *C* starts from one terminal of the alternating current-generator *A*, the other terminal being connected to earth. The smaller sheets of the condensers *F* are connected to the main *C*, while the larger are joined to one side of the lamp circuits and the current after passing through the lamps goes to the ground.

THE LUNGEN BELL.

The "Lungen" Bell.

Our illustration represents a new call bell named the "Lungen" after its designer, and recently brought out by Messrs. Edwards & Co., of this city. It embodies several novel features. Thus no casting whatever is used in the construction of this bell, all the parts being made of wrought metal by special tools. The smooth surface of the metal can be plated without difficulty and makes a beautiful finish. The combination of hammer, rod, ball, armature, trunnion, tension and interrupting spring, is such that none of these parts can work loose. The hammer rod passes through the side of the case in the direction of its pull, thereby obviating the large hole otherwise necessary. The adjustment of the interrupter through the side of the case is so arranged that the screw is kept in constant tension, and cannot move by the vibrations of the armature. The cover simply springs on without any other fastening, and remains firmly in position.

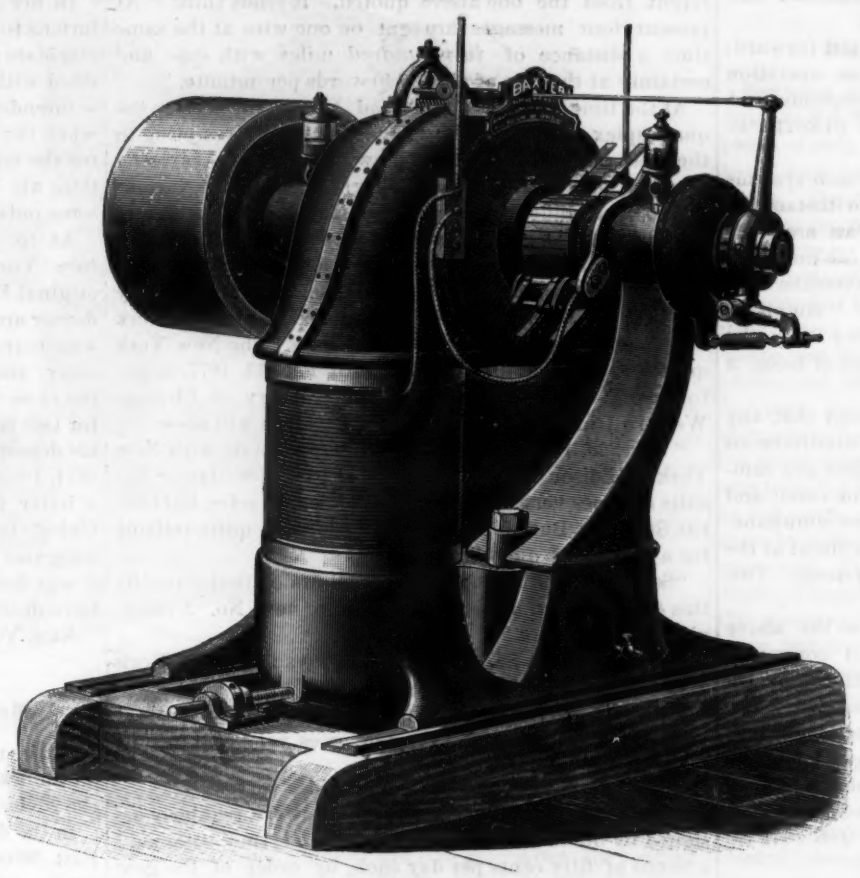


FIGS. 1, 2 AND 3.—THE PAISTE INCANDESCENT SWITCH.

Baxter Motors of Large Horse-Power.

In THE ELECTRICAL WORLD of July 28 last there appeared a cut and descriptive article of the Baxter 100,000 watt generator, with a statement that in the near future others of larger capacity would be placed upon the market, to satisfy a demand which is growing surely and steadily for generators which can be used in central stations for the distribution of larger units of power than with machines of the present capacity it is practicable to transmit, and also in the fields where the power of waterfalls may be advantageously utilized in the lighting or electric power supply of distant towns, and in furnishing the current to run the motors employed to drive the machinery in mines. That large generators and motors many times the capacities and powers of those of the present day will be the common feature of power transmission and distribution in a short time to come, no one who is familiar with the present status of the business and the growing demand for larger powers doubts for a minute.

The requirements of our electric age are essentially progressive, and with the characteristic energy and enterprise of the Baxter Motor Company we have in their generator a means for obtaining for long distance transmission the heavier currents which make larger units practicable; and in the motor, which we illustrate this week, for using these currents, the company take the next step which is destined to more fully realize the complete practicability of electricity as an agent to supply the demands of the largest manufacturing establishment or enterprise. The cut represents the type of the Baxter motor for all powers from 30 to 500 h. p.; it may be wound for any current from 40 to 500 ampères, according to circumstances. Thus a 40 h. p. motor would be ordinarily wound for 40 ampères, a 100 h. p. motor for 100 ampères and so on, which would also be varied according to circumstances or requirements. By a comparison it will be seen that this type of motor is constructed on the same lines as the generator, the noticeable difference in appearance consisting in the means for regulation in the two cases. Speed regulation in the motor is effected by the same device which is applied to all the Baxter constant current motors. This, as before described, consists in a contact roller and strips connected to sections of the field, the movement of the roller over the latter being entirely under the control of a centrifugal governor. This governor on all sizes of machines maintains the speed practically constant during the most violent changes of load. The generators made for central stations are wound for 40 and 100 ampères, and the motors for these circuits are wound to correspond to the particular circuit on which they are to run. In cases where it is desired to transmit the power of a waterfall as a unit, the current would be such as would be best adapted to the conditions.

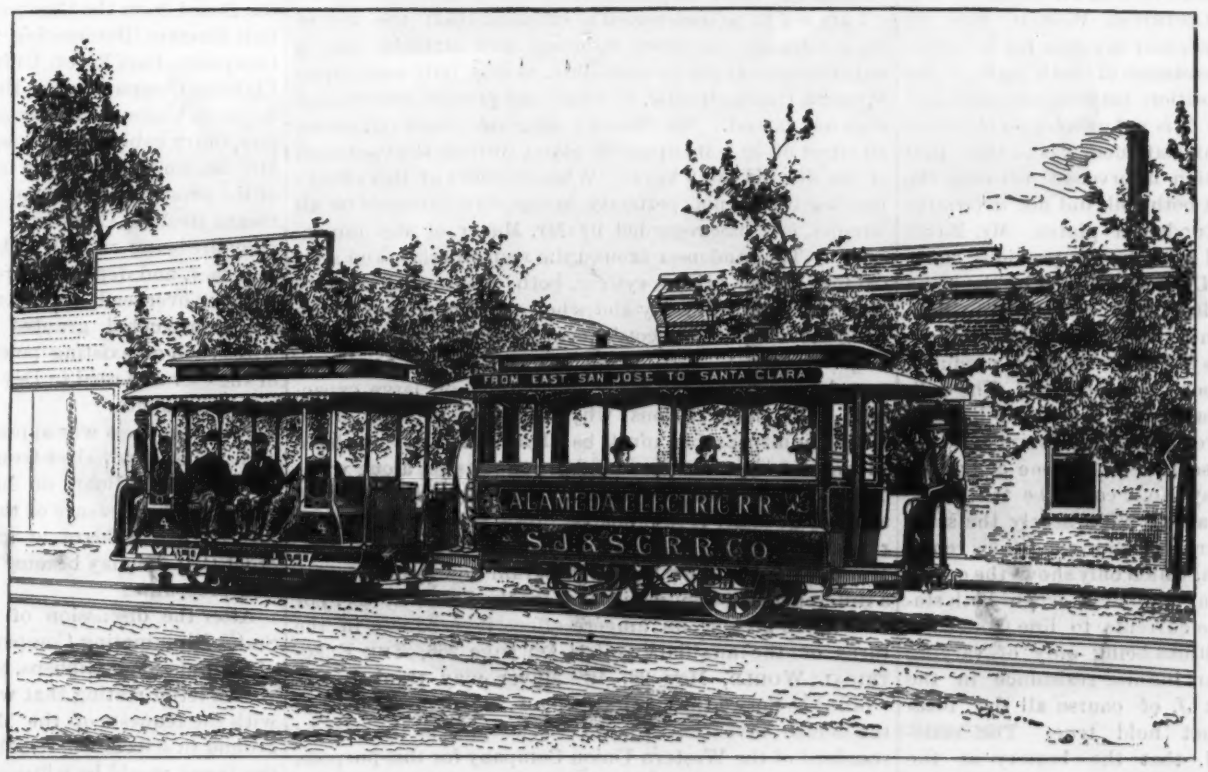


NEW LARGE BAXTER MOTOR.

The San Jose Cal., Electric Road.

California has proved a good field for the introduction of electric railways and bids fair to have a number of such roads out of all proportion to its population. One of the most noteworthy of its electric roads is that which has been installed and put in operation by Mr. Frank E. Fisher, the electrician of the Detroit Electrical Works, and of which we give an illustration on this page.

The San Jose & Santa Clara Electric Railway has been in successful operation since the 4th of September. The passenger traffic averages 130,000 per month. The present equipment consists of 12 cars, 6 dummies and 6 closed street cars. The construction is underground throughout, a little conduit on the Fisher system, with depressed rail, being used. The road starts at East San Jose, following Santa Clara street to the city limits, proceeding thence along the Alameda to the limits of Santa Clara, the road covering a distance of 4 miles. A double track is used, making 8 miles of track and 8 miles of underground construction. The speed averages 8 miles per hour through the city, and 10 on the Alameda outside of the city limits. The power station is equipped with two of the standard dynamos built by the Detroit Electrical Works, a Hazelton boiler, and a Wheelock automatic engine. The fuel used is crude petroleum, which costs $1.75 per barrel in San Jose, coal at present being $20 per ton. Notwithstanding the high price of fuel there is a difference of 50 per cent. between the cost of operating the electric cars and performing the same service with horse cars.



VIEW ON FISHER ELECTRIC ROAD AT SAN JOSE, CAL.

A Report on Execution by Electricity.

A committee of the Medico-Legal Society, of this city, has been investigating lately the methods proposed for inflicting the sentence of capital punishment by electricity. The committee was composed of Dr. F. Peterson, Prof. R. Ogden Doremus, Dr. F. H. Ingram, and Dr. J. M. Bleyer. It has now presented its report, which will be taken up at the December meeting. The experiments were made chiefly by Dr. Peterson, and have already been described in great detail in our columns.

Three methods of application were proposed by outsiders. One was the passing of electricity from wrist to wrist through the body; another was the passage of the current from the head, by means of a metallic band fastened to the forehead, to one of the wrists; by the third method a metal cap was to be placed on the criminal's head and his feet were to rest upon a metal plate.

The committee rejected all three on the ground that large electrode currents would be apt to produce convulsions. Near-by points were better and less dangerous to the operator. Suppose, they argued, that the wrist system were adopted, and the criminal should move his arm at the moment the current was turned on and strike the operator. The operator might also lose his life, if at the moment he happened to be touching the switch key. Disfigurement could also be entirely avoided by using small electrodes.

All nerves pass through the neck. The first method proposed was to place the positive electrode against the spinal column at the back of the brain, and divide the negative into two arms, one to be placed on either side of the throat in front, directly opposite the point where the positive electrode touched the spinal cord. The objection to this was that the strong current might disarrange the soft tissues of the neck, and furthermore would bring the two poles of the powerful current dangerously close together. The top of the head was next considered, and the distance between that and the back between the shoulders declared sufficient to avert the least danger from the current to those operating it. This plan suited all the committee, and experiments upon dogs proved it satisfactory.

A leather rest holds the criminal's head, and bands across his forehead and face keep him from moving. A metal bar tipped with a ball for an electrode is fitted to the top of his head. Another similar bar and ball touches his bared back between the shoulders and over the spinal cord. The electrode which touches his head is connected with the positive pole of the current. The one on his back is connected with the negative pole. When the poles are joined, the current will pass downward through the head and go out through the pole at the back. Electric currents diffuse themselves as broadly as the conductor will permit. The currents, therefore, almost completely fill the head and neck, swelling pear-shaped and tapering again enter the negative pole. This swelling of the current will cut every point of vital energy in the brain and the great nerve passages leading downward through the neck. Death is instantaneous and without a shudder. This is the way the committee described the process in the report submitted at the last meeting.

The electric current, in passing through the body from one pole to another, undergoes more or less diffusion through the tissues. A current passing from the top of the head to the small of the back will be diffused throughout a great part of the brain, and all of the tissues of the neck. The medulla oblongata—a part of the brain which is most vital—together with all of the great nerves of the neck and the spinal cord, which exercise jurisdiction over the movements of the lungs and heart, will be thoroughly permeated by the current applied in this way. As the seat of consciousness is in the brain, and particularly in the cortex of the cerebrum, it is clear that this faculty of the mind will suffer at once if the current be sufficiently strong. The electric stream flows from the positive to the negative pole, and there might be some possible advantage in placing the positive pole on the cortex of the head, nearest the centre of consciousness, although death in any case will be instantaneous. After mature deliberation they recommend that the death current be administered to the criminal in the following manner:

A stout table covered with rubber cloth, and having holes along its borders for binding, or a strong chair, should be procured. The prisoner, lying on his back or sitting, should be firmly bound upon this table or in the chair. One electrode should be so inserted into the table, or into the back of the chair, that it will impinge upon the spine between the shoulders. The head should be secured by means of a sort of helmet fastened to the table or back of chair, and to this helmet the other pole should be so joined as to press firmly with its end upon the top of the head. We think a chair is preferable to a table. The rheophores can be led off to the dynamo through the floor or to another room, and the instrument for closing the circuit can be attached to the wall.

The electrodes should be of metal, not over one inch in diameter, somewhat ovoidal in shape, and covered with a thick layer of sponge or chamois skin. The poles

and the skin and hair at the points of contact should be thoroughly wet with warm water. The hair should be cut short.

A dynamo generating an electromotive force of at least 3,000 volts should be employed. Either a continuous or an alternating current may be used, but preferably the latter. The current should be allowed to pass for thirty seconds.

Simultaneous Telegraphy and Telephony in America.

To the Editor of The Electrical World:

SIR: In the issue of THE ELECTRICAL WORLD for Nov. 17, an important inquiry is editorially made with reference to the simultaneous operation of telephonic and telegraphic transmission over the same wire.

Certain supposititious technical reasons are put forward; and an additional reason, *i. e.*, that such an operation requires the concurrent action of both telephonic and telegraphic authorities, is also given. THE ELECTRICAL WORLD is right on both counts.

The "successful" foreign operation of such systems must be taken in a comparative sense. Notwithstanding that it is abundantly proved that such systems are practicable, experience shows that this is one of the instances where a wide distinction is to be drawn between the two words "practicable" and "practical." The "simultaneous" operation of telephony and telegraphy over the same line or group of lines shows symptoms of being a "fine weather" system.

It may be set down as an axiom in telephony that any contrivance which increases the number of simultaneous uses of a line increases the untrustworthiness and complications of the said line in at least the same ratio; and it is certain that it is impossible to use a line simultaneously for telephonic and telegraphic service without at the same time affecting the efficiency of both systems. This refers, of course, chiefly to long-line work.

It is, moreover, also certain that in view of the above it is absolutely essential that both systems of communication shall be under the same control. Harmony between the two would not otherwise be possible. The telegraph interest would often be entitled to claim that the appliances of the telephone made the operation of the telegraph system sluggish; and the telephone people would as frequently find out that repeated re-adjustment, unremitting attention and the patience of Job were required in order to permit them to work at all.

BOSTON, Mass. THOS. D. LOCKWOOD.

The Quadruplex Controversy.

To the Editor of The Electrical World:

SIR: In order to prevent wrong conclusions and inferences, I think the following statement, for the benefit of your readers, should follow the publication of the letter of Mr. Wm. Maver, Jr., on "Improvements in the Quadruplex," on page 231 of your issue of Oct. 27.

On page 266 of THE ELECTRICAL WORLD, May 26, Mr. Maver says: "The condenser depends for its difference of potential on the resistance of both coils of the No. 2 relay. Owing to its position between the main and artificial lines, the condenser *C is not affected by the home battery.*" My criticism of this statement was to show that whereas a ground connection intervened between the main and artificial coils, that both coils did not determine the difference between the condenser plates. Mr. Maver now produces a diagram and retracts his previous statement "that the condenser *C* is not affected by the home battery," and asserts that it is, and, consequently, both coils of relay No. 2 do determine the potential of the condenser plates. I only need say that the diagram produced by Mr. Maver entirely supports my position. The ordinates of the varying pressures of the home battery, acting with or against the pressure of the distant battery, will show that either the resistance of the line coil or the artificial circuit coil of relay No. 2 could be taken out, and the condenser still be charged with nearly the same difference of potential under the very conditions represented in Mr. Maver's diagram, which only shows the operation of a quadruplex circuit at a moment when both stations simultaneously send the currents to line from their No. 2 transmitters, the conditions being only of varying frequency. If there were an infinite resistance in the ground connection at point *J*, of course all the foregoing conditions would not hold true. The statement that I have assumed, that the battery at the home station has internal resistance but no E. M. F., has a color of disingenuousness I am positive was never deliberately intended. I showed simply a ground connection of 500 ohms resistance, as the diagram in Mr. Maver's letter will verify. I assumed that a quadruplex was simply a double duplex and for all practical purposes the relays and condenser *C* were neutral to outgoing currents. I also think it is not seriously intended by Mr. Maver to show in his diagram and work out in his figures an E. M. F. without resistance, as he has done on page 231. He will arrive at somewhat different lines upon his diagram by reckoning on about two ohms per volt—the ordinary allowance. My statement regarding the displacement of batteries by dynamos may not be theoretically sound so far as affecting condenser *C* is concerned, and I desire to have it disregarded. The diagram of fall of potential given with my statement was sufficient to show that a variation of the internal resistance of the battery merely decided how far the resistance of both coils of the relay should figure in the difference of pressure between the condenser plates.

Mr. Maver alludes to a paper read by me before the American Electrical Society in Chicago, Feb. 17, 1875, and quotes from it as follows: "At the present time (Feb., 1875) four messages are sent at the same time a distance of nearly one thousand miles with the utmost ease and certainty at the rate of 120 words per minute." Referring to page 16, Vol. 1, No. 1, of the printed Journal of the American Electrical Society, the article is found in full. The statement to which Mr. Maver alludes is quite different from the one above quoted. It reads thus: "At present four messages are sent on one wire at the same time a distance of *two hundred* miles with ease and certainty at the rate of about 140 words per minute."

At the time this paper was read before the society the quadruplex was a new thing, and I was not attempting in the most remote manner to show the practical carrying capacity of a system upon telegraph wires of various lengths and under every-day conditions, but was merely dealing with the general features of the wonderful invention of Thomas A. Edison, as the curiosity of telegraphers was greatly aroused in regard thereto. At that time only two sets had been put up in Chicago, one on a New York wire, and the other on a Cincinnati wire. The New York quad was not put in operation until Feb. 15, 1877, as the following extracts from the Official Diary of Chicago Western Union Telegraph Company's office will show:

"Sept. 29, 1876. Been conducting quad tests with New York on Edison & Prescott quad for past few days. Results at times very good with Buffalo on all sides, but Gerritt Smith at Buffalo does not consider it quite reliable for a New York quad."

"Sept. 30. Still testing quad with Buffalo. Better results this evening than hitherto. Put in a new No. 2 relay, gives more margin."

"Oct. 3. Gerritt Smith, at Buffalo, says that New York (and Chicago) quad as such is a failure."

"Feb. 14, 1877. Mr. Hamilton here and Gerritt Smith at Buffalo trying to start N. Y. quad; goes very well to Buffalo."

"Feb. 15. N. Y. quad started, all sides very well."

"March 8. Four first-class operators were regularly assigned by me to the New York quad, and they were paid a bonus of fifty cents per day each, by order of the general superintendent."

Mr. Maver states "that the casual reader would assume that this reference to the condenser in the cross wires applies exclusively to the Jones condenser arrangement." The casual reader will assume what is true. General Stager received such favorable reports from all his superintendents on the great improvement of my differential arrangement that he had it replace the bridge system throughout the entire western division long before it was done in the East.

I am not to be understood as claiming that the use of the condenser *C* between the main and artificial line is indispensable at the present time, as it is only used upon Western Union circuits, to which my present observation does not extend. Mr. Maver's diagram, however, shows an effect of 50 volts upon the plates during the operation of the distant No. 2 keys. What becomes of this effect? Because it does not perfectly bridge the reversals on all circuits, is it not regarded by Mr. Maver of any importance? The condenser around the neutral relay, and a resistance in the bridge system, both when used directly around the neutral relay and when connected through the auxiliary coil of Prescott's neutral relay, was undoubtedly beneficial. My arrangement of the condenser gave better results by using condensers of large capacity. The only reasons why the arrangement is no longer indispensable must be that better devices have superseded it, or that because short circuits get along without it long ones will not work at all, even with its assistance. The latter is improbable, however, as the Smith arrangement is invested with so much importance. Mr. Maver does not show by his diagram how much greater a difference of potential is had in the Smith device, nor how much greater an ampère effect it produces in the turns of the auxiliary coil. On page 266, THE ELECTRICAL WORLD, May 26, Mr. Maver may think I have "failed to notice the significance of his suggestion" that the Smith invention "has been adopted as the present standard of the Western Union Company for this purpose, and its use has decidedly increased the working margin of the No. 2 side, *especially in fair weather. In wet weather*, however, its effectiveness is somewhat *handicapped* by the resistances *R R* in the main line which reduce the received current." I have long ago had reliable information that the Smith invention was taken out of the circuits on rainy days. The Jones arrangement always stood by the company in bad weather to the full extent of its value.

I have no objections to Mr. Maver's theory of the action of the condenser on the Smith condenser arrangement. I believed at the time it was correct. It was merely alluded to in my previous letter as showing that Mr. Maver's statement of the action seemed to me to be different from that of the inventor in his application for a patent. It was rather delicate for me to take sides. As to the comparative tests I made of condensers and coils, I certainly offered them for what they were worth, just as Mr. Maver has offered his views for what they are worth without the details. I had a practical difficulty before me to overcome, viz., to work a long wire quadruplex with the least interference of reversals on the No. 2 relays. I found reversal coils as I described were incomparably better than any other device known to me, and the fact stands self-demonstrated to the satisfaction of the parties directly interested. I should certainly consider myself wanting in responsible sanity if I were to attempt to cure the effect of reversals with a device which undid all the good result by introducing "drag" or lag in the apparatus. There is always a happy mean.

In my criticism of June 9, the allotment of 200 convolutions to each coil was entirely arbitrary and merely to elucidate my statement that if a relay has its bobbins filled with wire of suitable size for the circuit in which it is intended to work, that the relay will be much stronger when the convolutions are merely divided into two coils for the main and artificial circuits than if the convolutions are divided into three coils, one coil being used for some outside purpose.

As to my perversion of history in regard to the first New York & Boston, I was in error in saying that the original Edison system (set up Sept. 30, 1874) had a condenser around the neutral relay at that time, but believe I was correct in saying it had a single wound polarized relay and a single wound neutral relay included in the cross wires of a Wheatstone bridge. My authority for this is a diagram made by Mr. Thomas A. Edison, and his deposition to that effect. On the 12th of November, 1874, I visited Mr. Prescott's office at 145 Broadway with a letter from the Western electrician of the Western Union Telegraph Company to Mr. Prescott to give me diagrams and information of the quadruplex system, and it was described to me by Mr. Gerritt Smith exactly as I have described it in my former letter. F. W. JONES.

NEW YORK, Nov. 3, 1888.

Meeting of the New York Subway Board.

At the meeting of the Board of Electrical Control, held on the 13th inst., the first business before the Board was the revision of the new rules and regulations.

In the discussion which took place, Mr. Moore, of the East River Company; Mr. Cohen, of the Subway Company, and Mr. McGrath, of the Brush Company, made various suggestions. At its close, after the Board had invited the opinions of representatives of electric lighting companies or other persons interested, Commissioner Gibbens moved, and it was resolved, that the rules and regulations be adopted, and the secretary be directed to send copies of the same to the different electric companies, and that applications for permits be in order after Monday, the 19th inst.

A large number of applications for permits came before the Board from the Commercial Telegram Company, the Ball Electric Illuminating Company, the Western Union Company, East River, United States, Northern New York Lighting Companies, the Brush Company and others. The Western Union Company applied for permits for seven temporary cables on Broadway, and its representative, Mr. Brown, renewed his testimony as to the seriousness of the present condition of affairs in connection with the Steam Heating Company, whereby the wires of the company are being ruined. The Board promptly recognized this fact, and departing from its custom of refusing permits for overhead wires on streets where subways have been constructed, granted permits for two cables of 50 wires each on existing poles, from the City Hall station of the elevated road to Dey street, and thence to the down-town exchanges.

President Hess was appointed a committee of one to wait upon Mayor-elect Grant to convey him the congratulations of the Board on his election, and to state that it would be the pleasure of the Board to have him attend a meeting of the Board at any time he may designate in order that he may become acquainted with its business and procedure.

After the discussion of an application of the United States Illuminating Company, it was resolved, on motion of Commissioner Gibbens, that the application be returned with a letter stating that when the company had complied with the requests of the Board, to place its wires under ground in streets where subways have been constructed, the Board would be willing to consider such applications as the one in question, but not until then.

The secretary was directed to inform all companies having conductors in streets where the subways are completed to remove them within ninety days under penalty of prosecution according to the form approved of by the Counsel of the Corporation.

An injunction has been granted by Justice Lawrence, of the Supreme Court, in the suit of the United States Illuminating Company, restraining Jacob Hess and the other members of the Board of Electrical Control from interfering with the plaintiff's poles and wires until a suitable place for them underground has been provided, and from all acts tending to give the Metropolitan Telephone Company, the Western Union Telegraph Company and the

East River Electric Lighting Company other or greater facilities or privileges than shall be granted to the plaintiff. A motion to continue the injunction will shortly be argued.

The Colburn Arc and Incandescent System.

Messrs. I. W. Colburn & Co., of Fitchburg, Mass., have recently remodeled their forms of machines and brought out a complete system of arc and incandescent lighting.

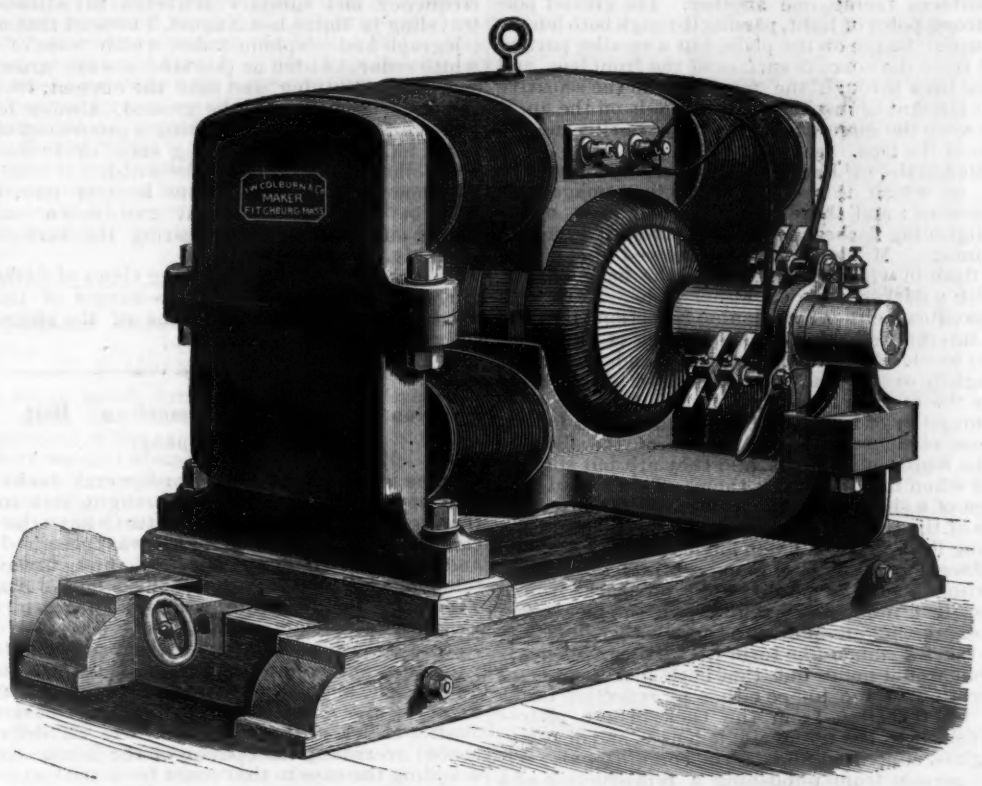
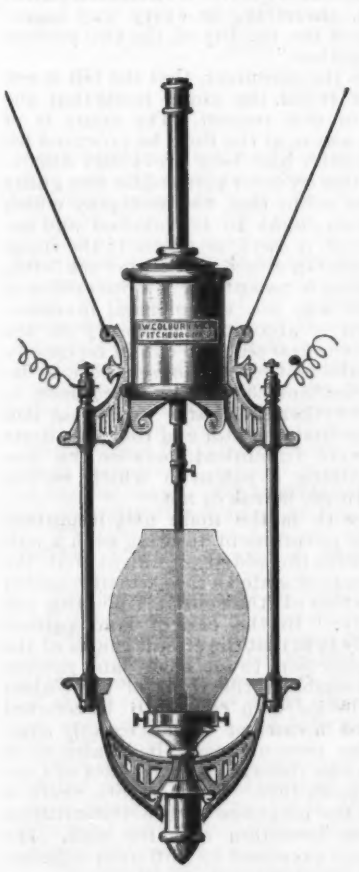
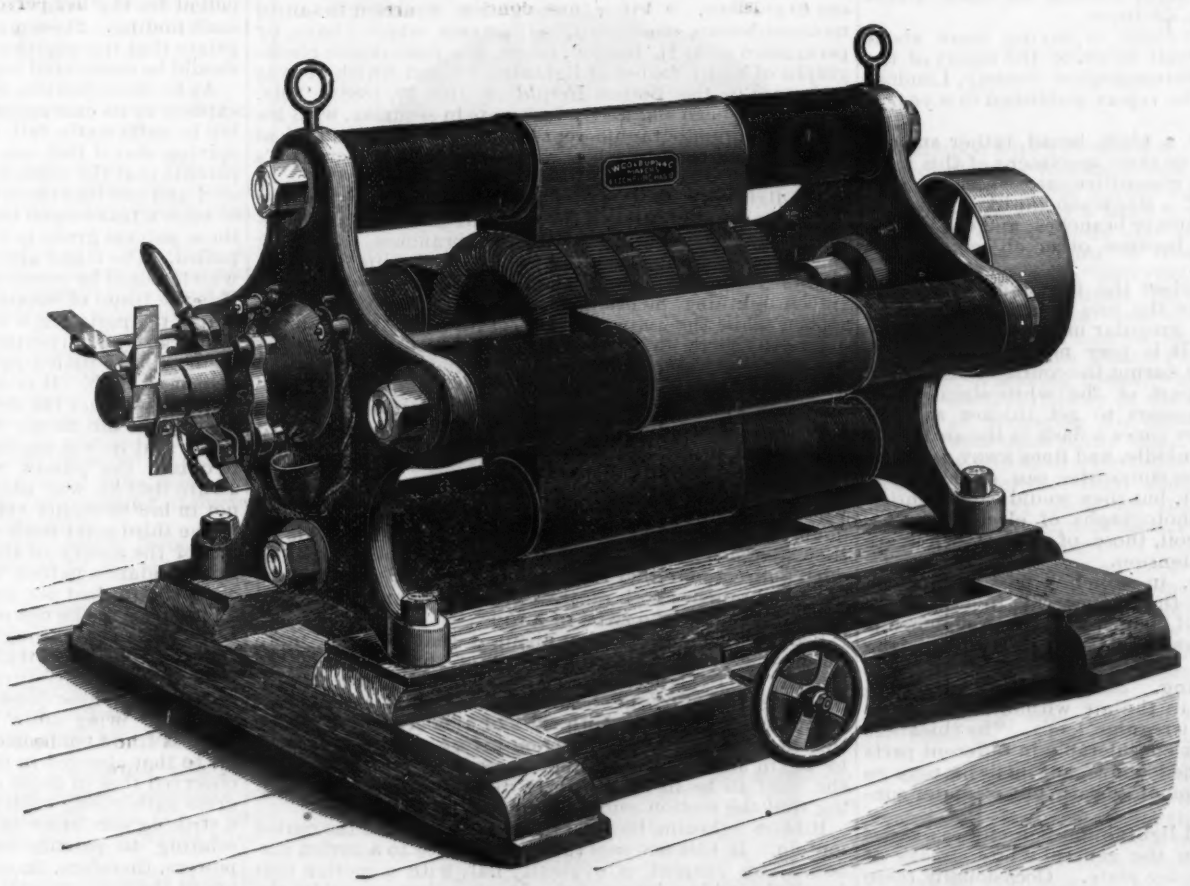


FIG. 1.—THE COLBURN ARC LIGHTING DYNAMO.

The arc light machine shown in Fig. 1 is of the consequent pole type and has a Gramme ring armature. The field magnets, as will be noted, have only two joints, the upper being bolted to the lower at the neutral point. The ornamental arc lamp employed is shown in Fig. 2. The feeding carbon is controlled by a main electro-magnet and a shunt magnet, which maintains the arc constantly at the proper length.

The incandescent machine which is illustrated in Fig. 3 has four poles and is automatic in its regulations. The armature is wound with two windings, one delivering the main current to the line, and another, consisting of a very few turns, the current generated in which energizes the field magnets. In this way, with a constant speed, the fields remain constant in strength independent of the external resistance, and thus from one lamp up to the maximum capacity of the machine may be in operation without change of potential. The incandescent lamp employed, shown in Fig. 4, is made in range from 12 to 100 c. p. The incandescent machines are made in size from lamps of 25 c. p., and another design for smaller capacity ranges from 5 to 15 16 c. p. lights.





FIGS. 2, 3 AND 4.—THE COLBURN ELECTRIC LIGHT SYSTEM.

Meeting of the American Institute of Electrical Engineers.

At the invitation of Gen. Alexander Webb, president of the College of the City of New York, the meeting of the American Institute of Electrical Engineers was held at the College, in the lecture room of Prof. R. O. Doremus, on Tuesday, Nov. 13. Over 100 members and visitors were present, who listened with great interest to the paper of Prof. W. E. Geyer on the Geyer-Bristol meter for direct and alternating currents. The instrument was shown in operation during the meeting, current being taken from the electric light plant at the college. After the reading of this paper, M. Abdank-Abakanowicz described his new magnetic call, and some interesting investigations upon it relating to the determination of the curve of E. M. F.; and the application of the integraph was also exhibited. M. Abdank described the integral curve derived from the curve of E. M. F., and explained other electrical applications of the instrument. Both these papers were discussed by various members of the Institute.

The meeting was closed by an explanation, given by Mr. Carl Hering, of the Carpentier melograph and melotrope. The object of these inventions is first to record the music of a performer upon the piano, and subsequently to give a reproduction upon the instrument itself. The melograph consists essentially of an arrangement of contacts under the keys, which, when depressed, mark upon a roll of paper the corresponding note and the time during which the key has been depressed. The sheet is then perforated in accordance with the markings made electrically, and this perforated sheet when run through the melotrope, *i. e.*, the instrument attached to the piano, serves to put in action hammers which depress the keys originally struck by the performer. After the explanation by Mr. Hering, M. Abdank put the melotrope in operation, and played various selections by the mere turning of a crank. Several novel effects were also produced by inserting the perforated sheet wrong side first into the machine, thus playing the tune backward, and also by turning the sheet upside down, so that the treble and the bass were interchanged. The instrument created considerable interest. After the meeting, the members, on invitation, inspected the laboratories and workshops of the College, and thus closed a very enjoyable evening.

The Management of Accumulators.

For some two years or more, says the London *Electrical Review*, Mr. W. J. S. Barber Starkey has been using sulphate of soda as the electrolyte in his storage cells, and he has always found it to prevent injurious sulphating of the plates. Recently he left home for three months, and during that period the cells were never charged. He examined them on his return, and could detect no difference in their appearance from the time they were last charged; they seemed to be in perfect order, the peroxide plates a dark brown, and the others like clean metallic lead. There was not a trace of white sulphate on any of the plates, and they lit up the lamps as brightly as if they had been just charged, although they had been left to themselves for three months. The cells have been in use for about three years, and although at first Mr. Starkey was troubled by the sulphating and bending of the plates, he has never experienced any trouble of any description since he added carbonate of soda to each of the cells, two years ago. He can now leave the cells with perfect confidence, if required, for several months without any charge. His charging current has always been limited to 12 ampères, but is generally only 10, and he always stops charging as soon as any gas is given off, although he is quite aware that this course is not usually adopted.

Heavy Snow on an Electric Road.

Two weeks ago the ability of an electric road to be operated successfully during a fierce snow-storm was successfully demonstrated in St. Joseph, Mo., upon the Union Passenger Railway in that city. On Friday, Nov. 9, one of the severest snow-storms which St. Joseph has ever experienced visited that city. According to the *Daily Gazette* of the next morning, "the big storm completely paralyzed business, and shut this section of the country off from communication with the world. The snow which fell was of the damp variety, and at 2 o'clock in the afternoon the loaded telegraph and telephone wires began to break under the pressure. Then the heavy electric light wires began to fall, and at 4 P. M. everything was demoralized. Many telephones were burnt out, and the entire system of the city was rendered practically useless."

In spite of all this storm the overhead system in use on the electric railway remained intact, and the electric cars continued to make their regular trips without stoppage or delay. According to the *Daily Gazette* before quoted: "There were present all the conditions which it was feared might impair the usefulness of the new motor, but not the least delay or inconvenience resulted. With the use of

two-fifths of the capacity of the plant, the usual number of cars were operated and made the usual time. And not only did the storm illustrate the reliability of the electric motor, it also showed that the Union Passenger Railway line people made no mistakes and did no poor work in constructing their line. Not a wire was broken down, nor was any other defect in the appliances developed. Telegraph wires were down in every direction, and the telephone wires of the city suffered great damage, but the wires on the Union Railway line stood the test without the slightest damage."

The management of the St. Joseph electrical road are so very well satisfied with their Sprague equipment that they have ordered an additional number of cars, and the Wyatt Park Street Railway in the same city has ordered a complete electrical equipment from the same company.

Peculiar Rotary Motions Found in Lightning and Other Electrical Currents.*

BY MOSES GREELEY PARKER, M. D.

Photographing lightning and making good pictures, representing the forked and irregular light as it shoots across the sky, or from cloud to earth, has become quite common, and is easily done in a dark night; having first focused the lens for distant objects, one has only to point it in the direction he expects the flash to appear, expose the plate and wait for the lightning. If the night is dark, one can obtain several flashes of lightning on the same plate, as they often occur near together. The only difficulty is to have the flash come within the field of the lens.

Photographing the current itself so as to get detail in the track, showing how the electrical currents travel, is quite another thing; this we have been able to do and present some results.

From these we see that the electrical current may travel without dividing; or it may divide and subdivide, twist and meander in its passage from cloud to earth, its image on the negative presenting such a variety in form, that many names have been given descriptive of its general appearance, without any reference to the real motion of the current itself.

Three of these motions I have observed, viz.: The twisted, the curled and the straight forward. Being unable to find anything descriptive of this in print, a short account may not be uninteresting.

The twisted motion resembles a loosely twisted rope; it twists both ways, usually from left to right, as the twining vine winds around its support. There are exceptions to this rule in the electrical, as well as the vegetable kingdom, for we find it twisting not only both ways (*i. e.*, from left to right and right to left), but it reverses its motion in the same course.

The curled motion resembles a twisted ribbon or shaving as it curls from the carpenter's plane, and in some respects is most remarkable.

The straight presents straight lines in its track, and is evidently traveling with great force.

Before describing the figures, or saying more about these currents, it may be well to quote the report of the committee of the Royal Meteorological Society, London, England, on lightning. The report published this year is as follows:

"1. Stream lightning, or a plain, broad, rather smooth streak of light. Only two or three specimens of this form have been received. The committee are disposed to consider this a distinct type of a single stream-like character without distinct irregularities or branches, and not merely the result of bad focusing, because other objects, such as trees, are extremely sharp.

"2. Sinuous lightning, when the flash keeps in some one general direction, but the line is sinuous, bending from side to side in a very irregular manner. This is by far the commonest type. It is very noticeable that the thickness of the line varies during the course of discharge. Sometimes the thinnest part of the white streak is the highest, and the flash appears to get thicker as it approaches the earth; at other times a flash in the air begins thin, broadens out in the middle, and fines away again at the farther extremity. The committee can offer no explanation of this at present, but they would call attention to the fact that in some photographs of electric sparks, taken from an induction coil, those of high tension are thinner than those of low tension.

"3. Ramified lightning, in which a part of the flash appears to branch off from the main streak, like the fibres from the root of a tree. Of course, there is no evidence as to whether these fibres branch off from, or run into, the main flash.

"4. Meandering lightning. Sometimes the flash appears to meander about in the air without any definite course, and forms small, irregular loops. The thickness of the same flash may vary considerably in different parts of the course, as mentioned above, and a flash may go pretty straight in one portion of its path, but meander considerably in another.

"5. Beaded or chapleted lightning. Sometimes a series of bright beads appear in the general white streaks of lightning on the photographic plate. Occasionally these brighter spots appear to coincide with beads in a meandering type, but often the beads appear without any evident looping of the flash. But as a flash is moving in space, while two directions only can be shown on the plane of the paper, there is every reason to believe that the brighter spots on the positive picture may be points where the flash was zigzagging, either directly toward or away from the observer, and thereby giving a somewhat longer exposure to those spots.

"6. Ribbon lightning. Nearly one-sixth of the photographs received by the society show flashes exhibiting more or less of a ribbon-like form. One edge of the ribbon is usually much whiter and firmer than the other. Occasionally in the same picture some flashes appear normal and others ribboned; but the flashes in a picture need not have occurred simultaneously. The committee have not yet in their possession any conclusive evidence as to whether the same flash may be normal in one portion and ribboned in another portion of its course. In one picture there is a bright streak on the top of the flash; then about an eighth of an inch of ribbon-like light, the folds following the sinuosities of the bright streak; then a dark band parallel to and following every irregularity of the bright streak, and then nearly another eighth of an inch of ribbon-like light. In another picture a very thin beaded flash has a precisely similar beaded streak, rather fainter than itself, running parallel to it at a distance of about a sixteenth of an inch on the paper. It might be suggested that the second fainter image was formed by internal reflection from the back surface of the glass plate; but it should be noticed that sometimes very thin flashes, which are not particularly bright, are so duplicated. A far more probable cause is the double image formed by the internal reflections of doublet photographic lenses. All doublets are essentially two meniscus lenses, mounted with their concave surfaces facing one another. The greater portion of a strong point of light, passing through both lenses, forms the usual image on the plate, but a smaller portion is reflected from the concave surface of the front lens, and from thence back through the rear lens to the sensitive plate. The amount of displacement depends on the angle formed between the direction of the bright point and the optical axis of the lens.

"M. C. Moussette, of Paris, showed some photographs of the sun, in which this double reflection image was very conspicuous; and there is not the slightest doubt that some lightning flashes are bright enough to give this secondary image, M. Moussette also showed the photograph of a flash in which the centre of the flash was the whitest, with a darker edge on either side. This may have been produced either by a double reflection from the lens, or by internal reflection from the back of the glass plate. Two bands of light—the primary and secondary images—slightly overlapping would form an extra bright band where the overlap took place.

"In the majority of cases, the folds of the ribbon formation are most obvious when the course of the flash is square to the width of the folds, and they are but slightly pronounced when in a line with them. This would suggest the idea of a shaking of the camera in the direction of the folds of the ribbon; but, if this is so, the duration of a lightning flash must be much longer than is supposed. The committee hope to have the opportunity of making some experiments on the photography of sparks from a coil or electrical influence machine. In the meantime, they defer expressing an opinion as to whether lightning ever really takes a ribbon-like form till further evidence is available, but would point out that both sources of error —the duplication of the image either by reflection inside the lens or by reflection from the back of the plate—would be avoided by the use of single lenses, and of paper, instead of glass, supported films. The committee also forbear for the present from publishing a reproduction of a ribbon-like flash till they are satisfied that such a form of lightning really exists, and that the whole appearance is not due to photographic causes."

Some two years ago, while experimenting with electricity, I obtained a photograph, showing the dividing and twisting rotary motion of the electrical current. My plate was not quite in focus, but the image is sufficiently sharp to show that the current divides and rotates, not only on itself, but upon its fellow.

Knowing, as we do now, that the current has a rotary motion, we can see in the main track indications of this motion that would be impossible for any jarring of the camera to produce. Further investigation disclosed the three motions before mentioned, to illustrate which I have, by permission of A. H. Binden, taken his remarkable photographs of many flashes of lightning,* about which it was truly said in the Boston *Herald* of July 29, 1888: "Mr. Binden has been singularly fortunate in securing, with his two plates, photographic reproductions of all the typical forms of lightning flashes mentioned in the committee's report."

The lightning flash examined as a whole, is seen to leave the cloud and reach the earth in an irregular, twisting, rotary manner, throwing off branches as it goes; these also twisting, rotating, and sub-dividing into the sinuous, ramified, meandering, beaded or chapleted, and ribbon lightning, mentioned in the Meterological Society's report, while the main current, rotating as it goes, finally enters the earth in a divided form, which plainly shows this twisting rotary motion in the main current as well as in its branches.

Stream lightning is well described by its name alone. In this form I find what I have called the straight-forward motion. Its photographs show almost straight lines without the curves indicating the rotary motion.

Sinuous, ramified, and meandering lightning are all very much alike, if we grant that which we can hardly doubt, viz., that they all may divide and sub-divide as they advance. In all of these we find a rotary motion, with a direction either from left to right, or right to left; in some branches both motions are found, and when well defined resemble the twist of a rope.

Beaded lightning has that about it that is much more interesting from a speculative point than either of the others. The explanation given in the Royal Meteorological Society's report of the beaded form hardly explains all that we find in and on both sides of this bead; for we see the rotary motion of this current before entering the bead to be in one direction, and immediately after leaving the bead to be in the opposite direction, plainly indicating that the motion sometimes changes in the bead.

Ribbon lightning has what I have designated the curled motion. In this one sees the resemblance to a curled ribbon. This current is evidently flat, with a motion that forms this ribbon into a curl. It somewhat resembles the beaded form, inasmuch as it is seen to change its direction, thus forming curls twisted in opposite directions and united, not by a bead, as in the beaded lightning, but by a white edge where the process of reversing its motion goes on, while at another point it presents the appearance of a curl pulled sidewise, being thin and narrow; afterward proceeding in a more regular manner than before. No possible shaking of the camera could produce this curled appearance.

That currents of electricity are influenced by the medium through or upon which they travel, is also seen, and to the well-known theory that the resistance of the air changes its direction, may be added, that the current changes in size and contracts in volume as it enters the earth.

If we compare the size of these currents with the trees or other known objects, seen in the same photograph, taking into consideration the distance each one is from the lens, one must, by comparison, judge the size of large currents to be, while passing through the air, *several feet* in diameter; distance must always be considered in judging the size, for as the current goes from the lens its image on the negative gets smaller, and larger as it approaches it.

Sparks from an induction coil or Holtz and other machines give the same indications of the three motions found in the lightning; they are easily photographed; the variety is not so great as in lightning, but one has an opportunity here of varying the current in many ways.

The three motions, the reversing of the rotary motion in the continuous track of a spark, as well as the bead, are found in these currents as in lightning, and add proof that these currents and lightning are similar.

With one observation more, I close this paper. No doubt many have noticed what I am about to mention, but its frequency last summer attracted my attention. While traveling in Maine last August, I noticed that many of the telegraph and telephone poles, which were of the native white cedar, twisted as this tree always grows, had been struck by lightning and that the current, traveling from the top of the pole to the ground, always followed the twist in the wood, often taking a groove out of the wood from top to bottom, winding once or twice around the pole following the grain of the wood.

Whenever it struck a pine hole or tree, these being straight without twists, it ran down on one side, taking out the groove or tearing the bark down on one side only.

(A large number of interesting views of flashes of lightning and a few of artificial discharges of induced electricity were illustrated by means of the stereopticon and fully described by the lecturer.)

* Read before the New York Electric Club, Nov. 15, 1888.

* See the ELECTRICAL WORLD, Aug. 18, 1888.

Decision Against the American Bell Telephone Company.

Some months ago, Solicitor-General Jenks, acting as attorney for the government, brought suit in equity in the Circuit Court of Massachusetts to have the Bell patent cancelled on the grounds that it was procured by fraud, and that Bell was not the first inventor of the telephone. A demurrer was filed by the American Bell Telephone Company, in which it was asserted that the United States had no right, in the absence of a specific statute granting that power, to bring a suit to cancel a patent for an invention. The demurrer was sustained by Judge Colt, and the matter was carried by the government to the United States Supreme Court on appeal. Justice Miller, of that court, on Nov. 12, delivered a decision, overruling the opinion of the lower court, and remanding the case to that court for a trial on its merits.

The demurrer offered was on three main grounds, upon each of which the Supreme Court has decided adversely to the American Bell Telephone Company. The first of these is that of "multifariousness." This is dismissed as of little weight. Although the bill does attack two patents, they both relate to exactly to the same invention, were issued to the same inventor, and are held by the same company. "There is no such diversity of the subject matter embraced in the assault on the two patents that they cannot conveniently be heard and considered together; and although it may be possible that one patent may be sustained, and the other may not, yet it is competent for the court to make a decree in conformity with such finding. It seems, therefore, in every way appropriate that the question of the validity of the two patents should be considered together."

As to the objection, in the demurrer, that the bill is not explicit in its charges of fraud, the court holds that the bill is sufficiently full in this respect. The court is of opinion that if Bell was aware at the time he procured his patents that the same matter had been previously discovered and put into operation by other persons, he was guilty of such a fraud upon the public that the monopoly which these patents grant to him ought to be revoked and annulled. The fraud alleged, it says, is precisely the fraud which would be committed in a case of the kind set forth. It is the fraud of obtaining a patent for an invention of which the party knew he was not the original inventor. The priority of invention is absolutely necessary to the right to have such a patent granted, and can in no case be dispensed with. It is sufficient for the present case to determine whether the defendants should be called upon to answer the bill, to say whether the charge made that Bell knew that he was not the first inventor and that his efforts to obtain the patent were fraudulent, because he was aware that he was obtaining a patent to which he was not in law or equity entitled, is true or not.

The third point dealt with is the main and important one of the ability of the government to bring such a suit to invalidate a patent, with the added argument that the complainant had not made or stated a case which required an exercise of the discretion of the court. Upon this the court rules very strongly: "In the case of land patents this court has repeatedly held that the circuit courts of the United States have jurisdiction to set aside land patents for fraud. These cases establish the right of the United States to bring suits in its own courts to be relieved against fraud committed in cases of a class exactly similar to that charged in the present case. It is also to be observed that in those cases there is no express act of Congress authorizing such procedure. Furthermore, there is a striking similarity in the language of the Constitution relating to patents for invention and for land. The powers, therefore, though exercised by different officers, are of the same nature, character and validity."

After discussing this point in its various bearings, the court remarked that the right of the government to bring this suit was based upon its legal or moral obligation to give a good title. It is urged, moreover, said the court, that because each individual affected by the monopoly of the patent is at liberty, when sued for using a patent without authority, to set up the defense that the patent was procured by fraud, that, therefore, the United States should not bring suit to vacate a patent. On this point the court says that, in the first place, the right given to the infringer to make this defense is a right given to him personally, and to him alone, and the effect of a successful defense of this character by one infringer is simply to establish the fact that, as between him and the patentee, no right of action exists for the reasons set up in such defense. But the patentee is not prevented by any such decision from suing a hundred other infringers, and putting each of them to an expensive defense, in which they all, or some of them, may be defeated and compelled to pay, because they are not in possession of the evidence on which the first infringer succeeded in establishing his defense. On the other hand, the suit of the government, if successful, de-

clares the patent void and puts an end to all suits, which the patentee can bring against anybody. It opens to the entire world the use of the invention or discovery in regard to which the patentee had asserted a monopoly. This broad and conclusive effect of a decree of the court in a suit of this character brought by the United States is so widely different, so much more beneficial, and is pursued under circumstances so much more likely to secure complete justice than any defense which can be made by an individual infringer that it is impossible to suppose that the government in granting the right named to the individual intended to supersede or take away the more enlarged remedy of the government.

In conclusion, the court says that there is nothing in the provisions contained in section 4,920 expressing an intention of limiting the power of the United States to get rid of a patent obtained from it by fraud or deceit. And although the Legislature may have given to private individuals a limited form of relief, the court thinks that this was not intended to supersede the affirmative relief to which the United States is entitled. The doctrine that the United States is not entitled to obtain the cancellation of an instrument obtained from it by fraud—an instrument which affects the whole public whose protection from such a fraud is eminently the duty of the United States—is not sound.

The Abdank Magnetic Call and Integraph.*

BY B. ABDANK-ABAKANOWICZ.

Permit me to speak first of a small improvement in magnetic calls. The instrument that you see here, Fig. 1, was constructed as long ago as 1882, when calls for telephones were wanted everywhere. The principle of this call is extremely simple. For producing electromotive force we are obliged to move a coil through a magnetic field. I fix my coil at the end of a straight spring, the other end of which is solidly held by the support. On the same support are fixed two magnets that create the magnetic field. If I move the bobbin from its neutral position, thus bending the spring, I am storing up the muscular energy of my hand in the spring. If I remove my hand this energy is restored in a series of oscillations of the bobbin through the lines of force. In this way an oscillatory current is produced in the closed conductor, and the mechanical energy reappears on the other side in the form of the movements of the bell striker, Fig. 2. I have made similar calls of different sizes, beginning with half the size of this one, up to others where the diameter of the bell was 3 or 4 feet. As the electromotive force developed is

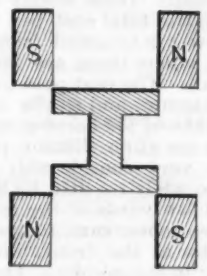


FIG. 4.

very high the working distance is very great. This small one can ring a bell to a distance of over 100 miles over an ordinary telegraph wire. We have tried successfully larger calls on lines over 600 miles.

The apparatus is an old one, and I give the short description of it only as an introduction to some theoretical remarks on its working. In this country calls approaching to mine, based on synchronous movement, were patented by Andrews and Watson. Mr. E. Meylan has lately made measurements in my laboratory for the purpose of finding the curve of electromotive force produced by the passage of the coil across the magnetic field, and this is the subject of my communication to-night.

If we admit that the instrument is symmetrically constructed and that the magnetic fields are equal in strength, then the curve of induced electromotive force must have a regular shape. We neglect also the retarding influence of eddy currents induced in the iron core.

We must have the greatest electromotive force in the middle, where the ratio of variation of the quantity of lines of force is the greatest.

The curve obtained by direct measurement was very different in shape, being as shown in Fig. 3.

This curve presents two remarkable features. First, we see a depression in the middle, where theoretically the electromotive force ought to be a maximum. The reason of this is to be found in the defective form of the iron core in the armature. The following diagram, Fig. 4, will clearly explain this.

This defect in the construction has a very bad influence on the result, the greatest and most useful electromotive force being lost, as shown in the dotted line, Fig. 3, and the same defect was often found by me in different alternating current dynamos.

The second characteristic feature of the curve is in the shifting of its ordinates in the direction of the movement of the armature. Beginning from the starting point the curve is convex and near to the other end concave in relation to the middle ordinate.

When the armature moves backward the same deformation was remarked, but in opposite direction.

The electromotive force produced was always somewhat behind the time in which it ought to have been produced. We supposed at first that this was due to the retardation in the indication of the electrometer used for the measurement, but we found by different controlling methods that this was not the case, and that this retardation is probably due to the action of eddy currents induced in the armature core. As you see, the maximum points of the curve are not symmetrically placed. This proves that the magnets did not possess the same strength of magnetic field.

The method used for the measurement of the ordinates of these curves was very simple.

The variation of the magnetic field in the path of the armature was also found experimentally, and then controlled by direct integration of the curve of electromotive froce.

The ballistic method was used for the measurement. This method allows of the measurement of the variation of the quantity of lines of force independent of the time. The total variation of the magnetic flux was found to be:

$$\Sigma\, d\, F = 5.1 \times 10^7 \text{ (C. G. S.)}$$

The mean current was 0.021 ampère. The mean power was 0.26 watt.

The curve of the variation of the magnetic field can be

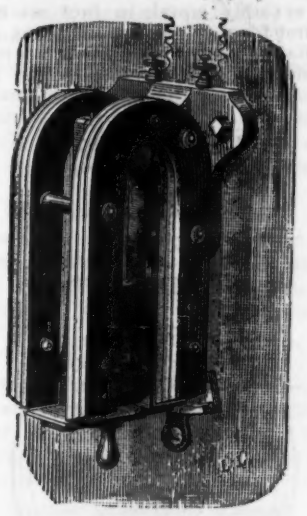


FIG. 1.—THE ABDANK MAGNETIC CALL.

found directly from the curve of E. M. F. as before alluded to.

Every ordinate of the curve of E. M. F. is proportional to the rate of variation of the number of lines of force. It is equal to the differential coefficient $\frac{d\,F}{d\,x}$.

Let us consider the two curves in their relation. Every ordinate, for instance $A\,B$, Fig. 5, is proportional to the rate of variation in the corresponding point of the second curve. This ratio is measured by the ratio $\frac{d\,y}{d\,x}$, where $d\,x$ represents time. The ordinate $A\ B$ in a given scale is equal to the numerical value of the differential coefficient. Every ordinate of the curve of E. M. F. represents the differential coefficient of the corresponding part of the magnetic curve. The magnetic curve is simply the integral of the E. M. F. It is obvious that if the equation of the E. M. F. were given, it would be possible to find the magnetic curve by integrating this equation.

This integration can be performed mechanically by an integrating machine. Before you is one of these machines

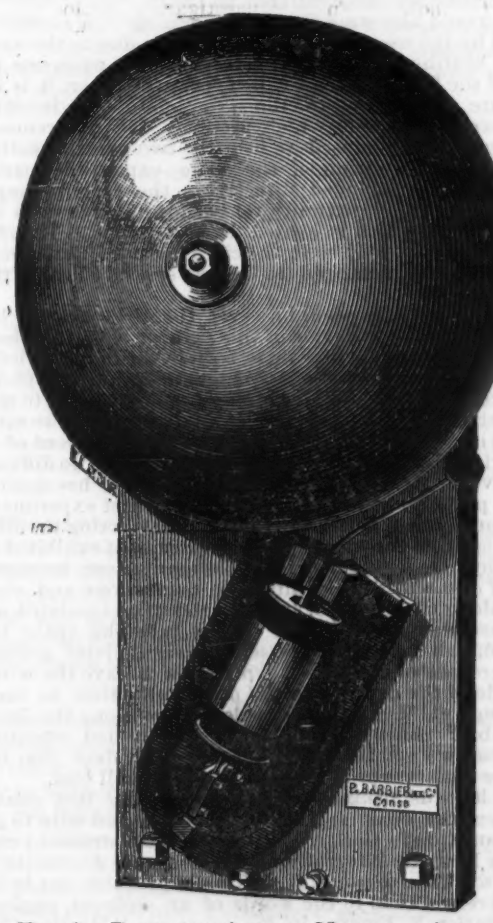


FIG. 2.—BELL FOR ABDANK MAGNETIC CALL.

constructed in Zurich by the celebrated constructor, Coradi. To perform the integration it is sufficient to follow with the tracing point the given curve. The integral curve is then mechanically traced by the instrument. (M. Abdank here exhibited his integraph and explained its action.) The integration of differential equations is a problem that we meet continuously in the physical sciences. We perform an integration in determining the area of a given figure; also in determining the static moments and the moments of inertia, in calculating the shape of the elastic curve.

The planimeter as you know gives mechanically the area and the moments. The instrument that you see before you gives much more. It traces a curve that indicates how the integral increases. The curve is the integral curve, the applications of which are extremely numerous. You have now seen one of these applications for the determination of the magnetic curve.

I am glad to have had the opportunity to present it to this electrical society, and, as it were, smuggle into your presence a mathematical instrument under the cover of an electrical application. And I do so because the apparatus interests me personally, being myself the inventor of it.

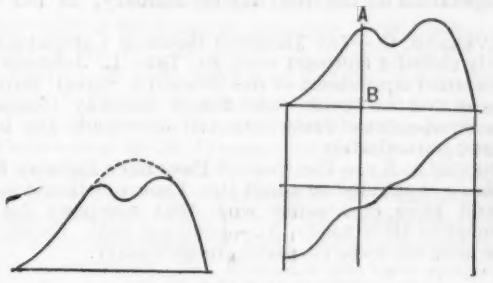
I must also crave your pardon for having addressed you in English, of which language I am not at all a complete master, and I am ashamed because that lack of knowledge is entirely contrary to my principles. I am of the opinion that every electrician ought to be able to speak English. He cannot be a good electrician without being a complete master of that language. Without an intimate acquaintance with the works of Faraday he is not able to draw conclusions in a simple and logical manner from experiments. He cannot—without being in direct communication with the legion of workers in electricity who speak the English language and who have advanced electricity in this country to a point where it is 50 years ahead of that in Europe, I say, that without knowing it intimately, he cannot keep track of what may be done with that power of nature which we are all attempting to harness.

* Read before the American Institute of Electrical Engineers, Nov. 13, 1888.

Some New Thomson-Houston Electric Roads.

The progress that the Thomson-Houston Company is making in the direction of the equipment of new roads is shown by the following brief summary of the new business which the company is doing.

OMAHA AND COUNCIL BLUFFS.—The electric railway between Omaha and Council Bluffs has been opened for general passenger traffic, and is now operating both to the satisfaction of the owners and the admiration of the general public. The road is nine miles in length, and at present is operating sixteen motor cars and sixteen cars without motors, each motor car towing one of the others. The cars are operated in a manner quite unusual on street railways. They are made by the Pullman Palace Car Company, and are connected by the vestibule device, in use for the first time here on street railway cars. They are very popular, and it is fully believed that ere long this method will come into more general use. Although the motors work equally well in either direction, a loop is made at each end of the track so as to permit the motor car to always run ahead. This road opens a new means of rapid transit between Omaha and Council Bluffs, which is highly appreciated by the residents of the two cities, they having been previously compelled to travel by special trains on the Union Pacific Railroad, which ran once an hour



FIGS. 3 AND 5.

and upon which twenty-five cents was charged. The fares upon the new line have been reduced to the usual street railway rates; but a speed equivalent to that of the steam road is made over a large portion of the track lying between Council Bluffs and the bridge over the Missouri River. Great credit is due to Mr. T. J. Evans and his associates in carrying through this entire project of rapid transit between the cities, they having expended not less than half a million dollars in constructing a magnificent bridge three thousand feet in length over the Missouri River. No expense has been spared in making the railway one of the finest, if not the best, electric railway in the world. Mr. Evans' original idea of arranging his cars is one which will eventually find favor upon many lines, as the carrying capacity is greatly increased over the ordinary cars. While this difference over the usual equipment impresses the visitor immediately, there are still many other features of the electrical construction and equipment that strike him forcibly as he progresses with his investigation. The neatness and simplicity of the overhead construction is considered superior to anything in that line that has yet been done, while the operation of the cars without noise is a matter which the advocates of electrical power scarcely believed could be accomplished until they witnessed the smooth running of the Thomson-Houston cars upon this line.

WICHITA, Kan.—Within the past few days the new Thomson-Houston railway has been put in operation, and is working more successfully than any one in Wichita believed was possible for an electrical equipment to do. The residents have all become converted to the opinion that electricity is the power for the operation of street railways. The cars are crowded with passengers who ride apparently for pleasure, and the receipts of the road are much larger than its most sanguine projectors dreamed of. The overhead construction is one of the most striking features, and is actually considered more of an ornament than otherwise, while the noise which it was feared would be made by the running of the electrical cars is found not to exist in the Thomson-Houston system.

LYNN, Mass.—The electrical equipment of the Lynn & Boston road, running through the most thickly settled part of Lynn, which has been furnished by the Thomson-Houston Company, will be put in operation during the coming week. The overhead construction on its line is the admiration of all who have seen it. In the construction of this road many difficult problems were met with and successfully worked out. The road has many curves, and grades as high as 12 per cent., making the construction work exceedingly difficult: yet all who have seen it speak nothing but praise for the successful manner in which the Thomson-Houston Company has done the work.

ANSONIA, Conn.—The Derby Horse Railway Company, operating with the Van Depoele electric system, is about to increase its equipment by the addition of considerable Thomson-Houston apparatus.

SYRACUSE, N. Y.—The Third Ward Street Railway Company (Thomson-Houston system) is to be started during

the present month. The equipment and overhead construction are very fine, and railway men in central New York are looking anxiously forward to see it put in operation.

DES MOINES, Ia.—The electrical equipment furnished by the Thomson-Houston Company for the Broad Gauge Street Railway Company is almost ready to be put in operation. Manager Teachout is exceedingly pleased with the apparatus furnished him, and the thorough manner in which the construction work has been done by the experts of the Thomson-Houston Company.

TOPEKA, Kan.—Work is progressing rapidly on the installation of the Thomson-Houston plant to operate the Rapid Transit Railway under the Thomson-Houston system. This road when put in operation will be the largest electrical railway in the world, being fourteen miles in length.

ALLIANCE, O.—Arrangements are being made to rush the construction and equipment of the new Thomson-Houston electric railway here, and it is proposed to have the line in operation within a few weeks.

NORTH ADAMS, Mass.—The electrical equipment of the Hoosac Valley Street Railway under the Thomson-Houston system, which it had been intended to defer until next year, will now probably be completed this season.

DANVILLE, Va.—The Thomson-Houston electrical equipment of the Danville Car Company's road was completed and the cars were put in operation Nov. 15. The road is operating with great success, and the officials are very much pleased with the electrical apparatus.

SCRANTON, Pa.—The Thomson-Houston Company have recently placed in operation three trucks on the Scranton Suburban road; three on the Scranton Nay-Aug road, in addition to the complete equipment of the Scranton Passenger Railway. These trucks are working with great success and elicit the highest encomiums from the officials of the road.

BANGOR, Me.—The Bangor Street Railway Company is being equipped with the Thomson-Houston system. This road is two and one-half miles in length and will operate two cars. The generator is on the ground and the construction work is nearly completed, so that it is but a matter of a few days before the cars will be in operation.

BOSTON, Mass.—On Nov. 7 the Cambridge aldermen granted the petition of the West End Company for pole rights in Cambridge, and the Thomson-Houston Electric Company is now actively engaged on the overhead line. It is expected that the cars will be put in operation in the course of a month or six weeks.

SEATTLE, W. T.—The Thomson-Houston Electric Company have shipped the cars for Seattle, and the overhead construction will soon be completed, so that the road will be in operation on the first day of January, as per contract.

CLEVELAND, O.—The Thomson-Houston Company have recently closed a contract with Mr. Tom L. Johnson for the electrical equipment of the Brooklyn Street Railway Company and the South Side Street Railway Company, for the equipment of forty cars, ten of which are to be delivered immediately.

LOUISVILLE, Ky.—The Central Passenger Railway Company have concluded to adopt the Thomson-Houston system, and have contracted with that company for the equipment of their road. The contract calls for 40 cars, 10 of which are to be furnished immediately.

The Geyer-Bristol Meter for Direct and Alternating Currents.*

BY PROF. WILLIAM E. GEYER.

In the meter about to be described we make use of the heating effect of the current. Electric measuring instruments depending on this heat effect are not new, as in the

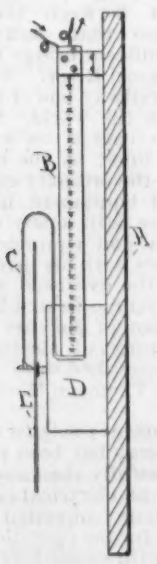


FIG. 1.—THE GEYER-BRISTOL SYSTEM.

Cardew voltmeter we have an application which has found much favor. Here the current of greater or less strength traverses a long thin wire, heats it more or less, and the direct expansion is a measure of the current, and indirectly of electromotive force.

In an ammeter it is necessary to keep down the resistance, and I therefore doubt whether direct expansion can be usefully applied for this purpose; for the actual elongation of a bar of metal, even when raised through a considerable range of temperature, is very small. In the familiar compound bar we have a case where a very small actual elongation produces a relatively very great lateral displacement.

I think I shall best be able to explain to you our meter, by recalling to your minds this old device. In the simplest compound bar two strips of metal which have different coefficients of expansion are securely soldered flatwise along their entire length. Brass and steel are metals frequently employed. On heating, the brass expands more than the steel, and, in consequence, the bar bends, becoming convex on the side of the brass. When such a bar is heated by the passage of the electric current, it will deflect, and this deflection may be made a measure of the current. The disadvantage of such an instrument would be that atmospheric changes of temperature would also cause deflection, so that troublesome corrections would have to be introduced.

In our meter we also use a sort of compound bar, but eliminate at once the effect of the surrounding temperature by taking metals whose coefficients of expansion are the same or sensibly equal; in fact we take the same metal. Our first form of construction was as follows: A wire of German silver is laid upon a strip of German silver of considerably greater cross-section and radiating

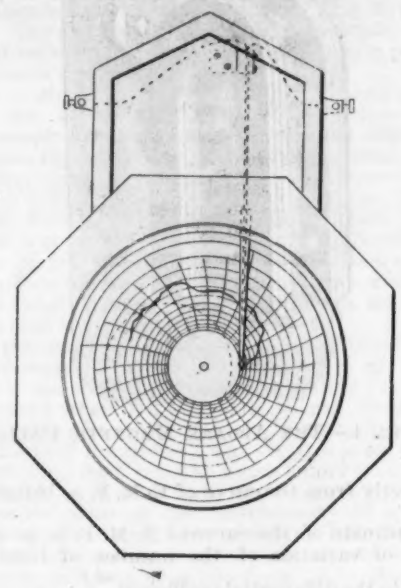


FIG. 2.

surface. The wire and strip are soldered together at one end, separated for the remainder of the length by a film of mica, then tied together at frequent intervals with silk or other insulating material, and suitably supported or clamped at the unsoldered end. If now a current, either continuous or alternating, is allowed to enter the strip at one end, it runs along its length, there enters the wire, and leaves the instrument at the other end of the wire.

For a given current the wire, on account of its greater resistance, and also on account of its smaller radiating surface, becomes hotter than the strip. In consequence of the difference of expansion the bar bends, becoming convex on the side of the smaller conductor. This combination we call a differential bar.

We would also state that inasmuch as the results obtained by the use of this instrument are due to the excess of the heating effect of an electric current upon one portion of the bar, or its equivalent, over the other, it is in a measure immaterial to the principle of the invention whether the current which produces the differences in temperature be caused to heat the two parts directly or indirectly. For example, the more expansible part, in lieu of being included directly in the circuit, may be arranged in close proximity to, but insulated from, a wire or conductor which is heated by the current. The other part or element may be in the circuit or not, but in either case formed or arranged to be less sensibly heated than the other.

It will readily be seen, however, that to heat one or both of the parts of the device in this manner would be clearly equivalent to connecting them both in series in an electric circuit. Unlike the case where magnetic action is employed, the force here available is very considerable, so that, to make the instrument self recording, it is only necessary to attach an inking device to the free end and move in front of it a properly ruled chart. In this respect we have no difficulty whatever. My associate, Prof. Bristol, who has done the larger part of the work, has, since our first experiments, very much simplified the method of constructing the differential bar, and the one used in the instrument exhibited was made by placing a flat strip of German silver between a pair of dies which make alternate depressions and elevations along the length of the bar; the wire, insulated with asbestos, was then slipped in the tube-like space thus formed, and the whole pressed between plates provided with grooves of the proper depth so as to leave the wire to one side of the centre line and at the same time to insure its being held firmly by the little bridges along the length of the bar. Since the bars can be constructed essentially by these two machine operations it is evident that they may be readily reproduced and at very small cost.

We have determined experimentally the best relation between the cross section of the strip and wire to give maximum deflection. We believe the instrument could readily be made integrating, but doubt the desirability of doing so. Our reason for this could probably not be better expressed than in the words of an eminent engineer, Mr. Charles E. Emery, in his paper on "Heating Cities by Steam," before the Franklin Institute, which we quote as follows:

"It was at first considered unfortunate that a reliable meter could not be obtained, which, like a water-meter would show by differences of reading the quantity of steam used for the interval between observations directly without calculation, and without expense of maintaining a time register at each location, and of integrating the charts afterward. This system, however, proved a blessing in disguise. The greatest difficulty in settling with consumers lies in the fact that employés waste the steam. This is particularly the case during the heating season, when steam for various uses is left on continuously during nights and Sundays, thus increasing the time of consumption from, say, 60 hours a week to 168 hours. In many cases, too, the rate of consumption keeps uniform during the night as well as during the day, so that it is an easy matter to more than double the bills. The consumers at first naturally lay the blame to the steam of the steam company, but the meter charts have been the means of enabling the company to satisfy consumers when, and to what extent, the increased bills were due to mismanagement on their premises."

Substitute electricity for steam and the reasoning will apply perfectly to our case.

In the accompanying illustrations Fig. 1 is a general view of the differential bar, mounted in a case with inker and recording dial. Fig. 2 is a side view of the important parts, the case being removed.

The following letters refer to the different parts:

A, supporting framework; *B*, differential bar; *C*, inking pointer attached to bar; *D*, clock-work moving dial; *E*, revolving dial for receiving record.

Fig. 3 shows a small portion of the bar and a cross section on an enlarged scale.

* Read before the American Institute of Electrical Engineers, New York, Nov. 13, 1888.

The Electric Road at St. Catherine's, Can.

The following interesting account of the Van Depoele road at St. Catherine's, Ont., has been contributed to the London *Electrician* by Mr. H. E. Dolan, of Toronto:

Thinking it might be interesting to your readers, I send the following short account of the St. Catherine's, Merritton and Thorold Electrical Street Railway, including (by permission of the president, E. A. Smyth, Esq.) some figures as to the cost of working.

The plant consists of one 100 h. p. generator, seven motor cars, and two cars without motors.

The main line is about five miles and a quarter, and a branch half a mile.

Working expenses per diem.

POWER STATION.		ROAD.	
Power	$0.83	Oil and waste	$1.00
Oil and waste	0.20	Brushes	0.30
Labor	3.00	Travelers	0.30
Depreciation on generator, at 3 per cent.	1.00	Labor	2.00
Depreciation on turbine, at 10 per cent.	2.70	Material for repairs of cars and line	1.70
		Depreciation on cars, at 15 per cent.	6.30
		Depreciation on line, at 10 per cent.	2.00
	$7.73		$13.60

Power station	$7.73
Road	13.60
	$21.33, equal to about £4 7s. 6d.

Seven cars at 72 miles per car gives $3.06 (12s. 3d.) per car, or $0.0424 per car-mile (equal to about 2.08d.).

As these figures were made out for comparison with the cost of horse-power the wages of conductors and drivers were not reckoned. These would average about $3 per car, bringing up the total cost per car-mile to about 4d. The motive power is obtained from Lock 12 of the Old Welland Canal, where there are 300 horse-power on a 12 foot 6 inch fall. The rent paid to the Government for this is $300 per annum, and as the turbine is only 125 horse-power, a balance of 175 horse-power remains. This is expected to be in use at no distant period, thus bringing the cost down very considerably. The generator is 100 horse-power separately excited, E. M. F. 500 volts, and is situated within a few yards of the middle of the main line. There are seven motor cars, four closed 10 feet long, which have the motor at the front, and three open 16 feet, with the motor in the middle. The motors are all 15 horse-power. Besides these there are two without motors, which are towed by the closed cars whenever there is any increase of traffic, as on market days, etc. When full the closed cars weigh six tons and the open seven tons (2,000 pounds to the ton).

The road on which the main line runs is a remarkably bad one for such a purpose. For about three-quarters of a mile from the St. Catherine's terminus it is level enough, although not straight for more than 300 yards at any one part. It then takes a sudden turn to the right and follows the line of the Old Welland Canal until Thorold is reached, over a succession of hills.

To give an idea of what the cars have to overcome, it will suffice to mention that the end of the track at Thorold is 287 feet higher than at a point four miles distant, and that in this four miles there are several dips that bring up the total height to be mounted to about 370 feet. Some of the grades are very bad, the steepest, although not the worst, being 1 in 15. The worst are two of about 1 in 20, these occurring on curves. Many of the curves are very severe, there being eight with radii between 35 and 66 feet, in addition to numerous easier. For the greatest part of the

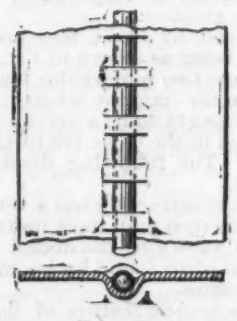


FIG. 3.

distance the line runs on the top of a steep embankment, at the bottom of which is the canal, rendering slow speeds an absolute necessity for safety.

The conductors are two hard-drawn copper wires $\frac{3}{16}$ inch diameter, supported on poles where the track is on the side of the road and on cross wires made fast to the houses where it is in the middle. They are about 19 feet from the rails in most parts, although in one or two places they come down to 14 feet to pass beneath bridges. On each wire runs a simple brass or iron wheel, which is connected to the car by a flexible cable to conduct the current. The figures given above are those for the first nine months, namely, from Oct., 1887, to July, 1888, and looked at in this light, together with the fact that the machinery had at the start to tackle a Canadian winter, they may be considered remarkably good.

Until last October the road was run by horses, and the work was so hard that a pair was required to take a car (10 feet long) to Thorold and back. They made one trip, and had six hours' rest before making a second. It was

very seldom that a horse went over the road three times in one day. Even then the conductor used to invite his patrons to walk up the steep hills. Since those days, however, matters have altered. First, there is a direct saving of $3.50 per car per day; secondly, three cars used to be ample for the traffic, and during winter it was a good month when receipts covered working expenses, the last car getting in at 8:40 P. M. Last winter the increased traffic required four cars every day after 12 o'clock, the last one getting home at midnight. Seeing this unexpected increase of business the company had three large open cars built for summer traffic, and since the beginning of June have had to put six on the road as a regular thing. Another advantage is that before it was impossible to take all the passengers that frequently wanted to ride, as the horses could not draw them; now as many as can get a foothold anywhere get on. It may be as well to mention that on this continent they do not trouble about carrying only a certain number in a public vehicle, but let every one who likes crowd in. On the 1st of July last (a public holiday) a crowd took it into their heads to come from Thorold to St. Catherine's to see a lacrosse match, and piled on to a car to the number of 125, making with conductor and driver 127. As none would get off, and all paid their fares, the conductor had to bring them. The great weight broke the car's back, but it got there all the same. On Aug. 10, I was riding on a car that was being towed. On the towing car I counted 50, and on the other 61, or 111 all told, plus about a dozen babies. This shows what a thoroughly good motor will do on an emergency. The people who use these cars would not go back to horses for anything. During spring the canal was emptied for a week, and the cars had to be run on the old plan, which resulted in much grumbling, and served as a good guide to public opinion.

A very important item is the matter of repairs to machinery. This has been very satisfactory, the only part that has required much attention being the brakes and the chains that run from the motor to the axle. The electrical part has stood the hard work well, and apart from the trouble that always occurs with new machinery, everything has done better than the most sanguine hoped for. Altogether, the proprietors are satisfied that they have made a good investment.

In addition to the main line, which runs from St. Catherine's through Merritton to Thorold, there is a branch wholly in St. Catherine's, about half a mile to the Grand Trunk Railway, Welland Division Station, to which cars run to connect with the trains. Another branch, about two miles, will be commenced shortly. This will run to the cemetery.

If any of your readers may happen to be traveling to or from Niagara Falls by the Grand Trunk Railway they will see this road, and pass within a few yards of the power station at Merritton. It will repay them to stay over for a few hours, and examine it.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Nov. 19, 1888.

Korting Gas Engines.

Mr. G. W. Silcox has moved his salesroom to his new factory, 431 Greenwich street, where he is now making Korting gas engines instead of importing them.

Vacuum Pumps.

Mr. H. Jaeger has moved to his new factory at 45 John street, where he will continue the production of his well-known glass vacuum pumps. Mr. Jaeger furnished all the pumps now in use at the Sawyer-Man lamp factory.

The E. P. Gleason Manufacturing Company,

of Houston and Mercer streets, have increased their factory room twofold, and have devoted the second floor of their store to the display of chandeliers, fixtures and fittings in all styles and qualities. They will now, they hope, be able to keep up with their orders.

Zimdars & Hunt.

The above concern, of 237 Mercer street, having established, like some of our campaign spellbinders, quite a reputation for their "oral" goods, have added a large variety of electrical supplies to their business and are not dissatisfied with the result. A novelty they show, of interest, is a large hall clock, the mechanism of which is controlled by electricity.

The Shaver Corporation.

This corporation is now in the hands of a number of pushing and progressive men. Mr. R. L. Edwards, the new president, is president of the Bank of the State of New York. Mr. J. W. Ogden, a well-known railroad men, is treasurer. Mr. G. F. Shaver is vice-president. They have sold the right to operate in Westchester County to the Shaver Telephone Company, Limited, of which Mr. J. W. Todd, owner of the large office building, 20 Maiden Lane, is president; Mr. H. B. Stokes, vice-president of the Manhattan Life Insurance Company, is treasurer; Mr. Bissell, president of the Bank of New Rochelle, is the secretary. The offices of the Shaver Corporation are at 120 Broadway.

A Few More Institute Fair Notes.

Mr. J. S. Hall, of 40 Cortlandt street, has a fine display at the fair of lubricators and oil cups for dynamos, engines and other high-speed machinery. Mr. Hall has worked for a great many years at his special devices in this line, and now finds the cups not only in demand, but receiving the disagreeable compliment of imitation.

At the left hand of the central fountain one's eye is greeted by long rows of Hussey batteries made by the Eclipse Electric Company. In the space occupied by this exhibit is a large easel and frame holding an exhibit of the Empire City Electric Company's make of bells, annunciators and burglar alarms. Suspended from the easel is a cell of Hussey battery used in ringing the bells. The exhibit includes also a number of C. & C. motors.

Hine & Robertson have excelled themselves in ingenuity by showing in their exhibit a snake, composed of their Eureka packing, coiled around a tree. The design is very neatly worked out. They show also their damper regulator, which regulates on a variation of less than a pound of steam. Another exhibit is their "eliminator" for cleansing exhaust steam or for taking water out and delivering dry steam to high-speed engines. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Nov. 19, 1888.

A New Electric Club.

It is reported that steps have already been taken by some of the scholars at the Massachusetts Institute of Technology toward organizing an electric club, composed exclusively of students in the electrical departments of that institution.

Everett, Mass., to have Electric Lights.

At the town meeting in Everett, last week, it was voted to authorize the selectmen to contract with the Malden Electric Company for the lighting of the streets next year and further extend the electric lighting system, and $5,000 was appropriated therefor.

The "West-End" Electric Road.

Work on the electric street railway of the West-End Company from the corner of Beacon and Charles streets, Boston, to the towns of Brookline, Arlington, and Brighton, is being rapidly pushed forward. Contractor McQuesten is accomplishing a great work.

Brush Electrics at Webster.

The Slater Woolen Company, at Webster, Mass., is having its works wired for an incandescent plant of 450 lights by the Brush Electric Company, of Cleveland, O. The Slater works have had in operation for eight or nine years one of the first machines made by the Brush Company.

Electrical Accumulators in Maine.

Messrs. Grant & Story, of Bar Harbor, Me., agents in that State for the Electrical Accumulator Co., have installed and in successful operation central storage battery stations in Cherryfield and Brunswick, and have just ordered outfits for similar stations at Ellsworth, Dexter and Bucksport.

Thomson-Houston Arcs at Manchester.

All the arrangements, I am informed, for the installation of a 200 arc-light plant (Thomson-Houston system) for the Manchester, N. H., Electric Light Company, have been consummated. Mr. A. B. Griggs, one of the most active and popular of the Thomson-Houston Electric Company's agents, made the arrangements and effected the sale.

Removal.

On Monday, Dec. 3, the Sawyer-Man Electric Company's Boston office will be removed from No. 33 Federal street to the "Hathaway" building, No. 620 Atlantic avenue. The new offices will be on the first floor at the southwest corner of the building and immediately under those occupied by the Thomson-Houston Electric Company.

Mr. Pettingell on the Road.

The senior member of the firm of Pettingell & Company started from Boston on Nov. 15 on a fortnight's trip among old customers and friends. His object is to invite attention to the commendable and flourishing enterprise with which he is now identified, and his firm's ability to supply the best of everything known in the category of electrical goods and electric light supplies.

Damper Regulators in Demand.

Mr. G. G. Stillman, of the Eastern Supply Company, Boston, reports that the sales of the Spencer damper regulator are constantly increasing, particularly so among the electric lighting interests. The Edison Electric and Illuminating Company and Tremont Electric Light Company, both of Boston, have just purchased a Spencer damper regulator respectively.

A New Mast Arm.

The Russell Electrical Manufacturing Company, Providence, R. I., has perfected a device for suspending arc lamps over streets, midway between the curbings. These arms can be made any length; and by means of a suspending cable, lamps may be carried to the centres of the largest public squares, causing no interference to traffic, no inconvenience to the operator during the most severe storms and no possibility of damage to the lamps.

Telephone vs. Electric Light.

Superintendent G. E. Hanson, of the New England Telephone & Telegraph Company, notified Mr. A. E. Bliss, superintendent of the Malden (Mass.) Electric Light Company, last week that the electric light wires and cross arms on the telegraph poles opposite City Hall must be taken down before night or the telephone company would cut them down. Superintendent Bliss says the wires were placed there by agreement with the telephone company.

Sawyer-Man Incandescents.

Among the incandescent electric light installations made by the Sawyer-Man Electric Company through its Boston office recently are the following: 500 lights (compensating system) at the station of the Walworth Light and Power Company, Hawley street, Boston; 200 lights (straight incandescent), at the works of Carter & Rogers, Lebanon, N. H.; 75 lights, at factory of Messrs. C. D. Morse & Co., Milbury, Mass.; 30 lights, at the establishment of Charles Heap in South Boston, and they have just commenced work on a 350 light incandescent plant at the cracker factory of F. A. Kennedy, Cambridgeport, Mass.

A New Telephone Exchange.

Through the courtesy of Mr. A. C. White, superintendent of the Providence Telephone Company, I obtained the following information: The company named will soon have a branch office at Pawtucket, R. I., and probably will be ready for business in December. It will be fitted with one of the Western Electric Company's new style of switch-boards, known as the "single cord multiple system." This will give the Pawtucket exchange a capacity for 1,000 lines. The operating room will be spacious, nicely lighted (day and night), and thoroughly ventilated. Telephone business in Pawtucket is booming, and with the improved facilities given by the new exchange the company expects a large increase in its number of subscribers.

Electric Illumination for Taunton, Mass.

I have it on excellent authority that the Taunton Electric Light Company has decided to increase the lighting capacity of its station, and, in the future, will use exclusively Brush arcs and incandescents. Mr. C. S. Haley, the special agent of the Brush Electric Company, of Cleveland, Ohio, reports having closed with the company named for the new equipment, which will consist of three 45 arc-light and one 600 light incandescent machines. Space will be set aside for doubling the lighting capacity referred to. The outlook justifies the prediction that such an increase will be necessary before another 12 months rolls around.

"Ball" Lights at Stoughton, Mass.

From the Boston *Daily Advertiser* of Thursday, Nov. 15, I copy the following:

During the past twelve months certain leading citizens of Stoughton have been making an investigation into the various systems of electric lighting for street and commercial purposes, and have just been incorporated as the Stoughton Light, Heat and Power Company, and have contracted with the Ball Electric Light Company, of 63 Equitable building, Boston, for one of its 70-light dynamos, four ampère and 800 candle-power light plants. These lights will be largely distributed through the streets of the town.

The Standard Electric Company of Vermont.

This company—as yet a new-comer into the electric lighting field—is already well started on the road to success. It has made several very satisfactory isolated plant installations. The machines are all doing good work and the lights are giving satisfaction. A plant of 600 incandescent lights has just been installed at the factory of Isaac Prouty & Co., at Spencer, Mass. Among the other isolated plants installed by the Standard Company of recent date are the following: 175 incandescent lights in one of the mills of the Amoskeag Manufacturing Company at Manchester, N. H.; an arc light plant at the mills of Sayles & Nichols, Pascoag, R. I., and an incandescent light plant at the Wilson mill, same town.

Personals.

Mr. Frank J. Sprague, of New York, was in this city a day or two last week.

Mr. Wilfred H. Fleming, for some time past the Alabama agent of the Sawyer-Man Electric Company, favored this office with a visit on Tuesday of last week.

Mr. A. H. Patterson, manager of the Phœnix Glass Company, of Pittsburgh and New York, was in Boston on Thursday last.

Mr. Halvorson, of the firm of Loveridge & Halvorson, electricians and dealers in electrical supplies, Portland, Oregon, has been in Boston for two weeks past.

Mr. Geo. T. Manson, the "Okonite" man, was a welcome visitor to this office on Thursday of last week.

An Interesting Lecture.

At the rooms of the Boston Electric Club, on Wednesday evening, Nov. 14, Mr. F. J. Parsons, Ph. D., gave a most interesting and instructive talk on the subject of "Central Station Practice in Germany." There was a good attendance of members, who listened with attention to the many interesting details that were placed before them by Mr. Parsons, who has had a large and extensive experience in Germany. A lively discussion ensued, and this was followed by a few words from Mr. Tei Hasegama, M.E., a Japanese gentleman who is over in this country studying the methods of electric lighting and power, as a representative of the Japanese Government. Mr. Hasegama has been appointed to introduce the new mode of illumination into the principal cities of his native country.

Boston Electric Club.

On Monday evening, Nov. 12, this organization held an adjourned meeting at its club rooms, and discussed the question of change of quarters. No. 2 Mt. Vernon street, opposite the State House, was definitely decided upon as the future club house. The new quarters will probably be taken possession of about Jan. 1, 1889. Messrs. Jno. C. Wilson, Wm. O. Webber and Otis K. Steuart, the committee on selection of new quarters, have received the thanks of the members of the club for their arduous labors and ultimate success in obtaining a club house of not only large proportions, but of desirable location and at a reasonable rental as well. Steps were also taken at the Monday night meeting that will place the club on a permanent financial basis. Every member who has the interest of the club at heart will promptly respond to the call of Treasurer Boynton. At the same meeting a committee was elected to make and present nominations for officers for the ensuing year, to be voted on at the regular monthly meeting of the club Dec. 3. The committee consists of the following members, viz.: A. L. Rohrer, H. B. Cram, Dr. Amory, W. J. Denver and C. M. Ransom.

New Catalogues.

The Massachusetts Auxiliary Fire Alarm Company—a branch of the Rogers Alarm Box Controller Company, of Providence—has just issued a small and attractive catalogue, containing a description of and humorous testimonials regarding this remarkable and meritorious system of announcing fires from any desired point without recourse to the street boxes of the fire department.

The Thomson-Houston Electric Company has recently had printed a large and artistically illustrated catalogue, in which its every department, and all the apparatus and appurtenances respectively, are elaborately and comprehensively treated upon.

The Robinson-Foster Railway Motor Company, a corporation which has just established itself at No. 7 Exchange Place, Boston, has issued to the public a neatly illustrated pamphlet, announcing that it is prepared to furnish a system of electric railways, second to no other in existence.

Standard Electric Time Company.

This New Haven corporation, already familiar to your readers, is meeting with encouraging support from various sections of the country, particularly in New England. The company has been constantly increasing its agencies, and has now a well-appointed branch office at No. 315 Wabash Ave., Chicago, with Mr. G. A. Harmount in charge. The parent company has made arrangements with Mr. Harmount to act as the Western Agent, not only for the Warner Electric Time System, which has become so popular in New Haven, Waterbury, Bridgeport, Danbury, and elsewhere, but also for the Warner electric pocket gauges for testing the strength of batteries of all kinds, and also the Warner electric light current testing gauges. The company has been remarkably successful in its dealings with large manufacturing establishments, having equipped numerous factories with its system of electric time.

St. Johnsbury, Vt., to Have Electric Lights.

Mr. W. A. Stiles, one of the selling agents of the Thomson-Houston Electric Company, reports having closed a contract with the authorities of the town of St. Johnsbury, Vt., for the installation of an electric light station consisting of 40 arc lights and 500 incandescent lights. This contract, said Mr. Stiles, is for the period of three years. The arc lights will run up to midnight and the incandescents all night. The power will be exclusively derived from water power sources and two Victor turbines will be used. There is sufficient room in the flume for another turbine when the capacity of the station is increased.

The Thomson-Houston Company has again, in this case, demonstrated its shrewdness by securing a ten years' lease for use of the water-power. This lease, together with the contract for furnishing the electric lights, said Mr. Stiles, was obtained after a hard fight of six months' duration, which is all the more gratifying to the Thomson-Houston Company, and the indications point to a permanent field of operation for the system of the company named.

Prospects are favorable for using a large number of Thomson-Houston stationary motors, as already there have been inquiries for several of these motors ranging from one to fifteen horse-power.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Nov. 17, 1888.

A Small Motor.

Messrs. Harbach & Co., of 809 Filbert street, have one of the cheapest motors on the market. It is quite small, but can be adapted to many uses in experimental work or for amusement. Harbach & Co. carry an immense stock of novelties in almost every conceivable line of goods, and do a very large business.

The Phonograph.

Joseph M. Shoemaker & Co., who represent the Eastern Pennsylvania (Edison) Phonograph Company, have opened an office at No. 112 Custom House Place, Drexel Building, where subscription books for the stock of the corporation are open. Many of the callers are highly amused listening to the notes of Levy's cornet.

Arcs Triumphant.

A sub-committee of the Gas Committee of Councils met last week to consider a proposal to replace the Siemens gas lamps in the public squares with burners of improved pattern. Director Wagner suggested that the lamps should be removed and electric lights erected in their place, and a resolution authorizing the substitution was adopted.

The Cleverly Electrical Works

received, a few days ago, probably the largest single order for desk or push buttons ever placed with one establishment in the country, it being for no less than five thousand buttons. This, with several smaller orders on hand, swells the number of these buttons to be turned out by the Cleverly people in the near future to over seven thousand. Mr. Cleverly reports a rushing business in Baxter motors, and the new Microphone battery, for which his house is the agent.

The Thackara Manufacturing Company,

of this city, are doing a large amount of work in the line of both electric light and combination gas and electric light fixtures, which are being placed in nearly every new house or building in the city in anticipation of electric service at some future time. The extensive underground work of the Edison Company will afford an opportunity to many anxious householders and builders to secure electricity for lighting purposes, consequently there is a great demand for combination fixtures, as well as a large number of calls for the alteration of gas fixtures now in use into combination. The firm are crowded with work of both kinds.

Taxing Electricity.

A telegram from Harrisburg makes the novel suggestion as to whether electricity is a "condition or a thing." It says: "Although philosophers have never been able to determine whether electricity is a condition or a thing, a case will be tried by the courts of Dauphin County next month in the hope of throwing light on a very ancient dispute. Under the act of 1885 manufacturing companies in Pennsylvania, with few exceptions, are exempt from taxation. The State authorities have refused to recognize electric light companies as manufacturers, and several of these corporations have appealed from the settlement of the tax which the Commonwealth has imposed upon them. The novel point to be decided is whether or not electricity is manufactured.

Underground Wires.

Councils' Electrical Committee held a meeting last Wednesday to act on an ordinance to limit the scope of the existing ordinance which prohibits the opening of the streets between Dec. 1 in any year and the first day of March following. The object of the proposed new law is to allow the streets to be opened during the time named in the prohibitory measure for the purpose of laying or repairing underground service pipes for the introduction of the electric light into buildings and dwellings. Samuel B. Huey, counsel for the Penn and Edison electric light companies, addressed the meeting, saying that those corporations require such a law for the proper operation of their plants. Chief Walker, of the Electrical Bureau, said that he had been requested by Director Wagner to state that the latter official hoped the bill would not pass. Notwithstanding this, Mr. Boyer moved to report it to Councils with a favorable recommendation. Mr. Wagner, of the Twenty-fifth Ward, made a speech against the ordinance, but Mr. Boyer's motion prevailed, after a limitation of the provisions of the ordinance to March 1, 1889, had been made.

The Sprague Electric Railway at Harrisburg, Pa.

The report of the East Harrisburg Passenger Street Railway at Harrisburg, Pa., for September last is very encouraging for those managers of street railways who intend to install the Sprague system. The cost of operating five cars over five miles of track, from 5 A. M. to 1 A. M., 18 hours each day, during the month of September, was $1,200. This includes all salaries, repairs, insurance, oil and waste, fuel and the expenditures of every sort and description. During the same month the receipts were $3,600, giving a net profit in operating the road of $2,400, or 30 per cent. on the capital stock, per annum. The amount of fuel consumed in operating this number of cars during these hours averaged less than three-quarters of a ton per day.

The management attributes the success of their electrical equipment to the superior quality of the Sprague apparatus, and its low cost of maintenance and operation, and they are so very well pleased with the use of electricity as a motive power that they have ordered an additional equipment of cars from the Sprague Electric Railway and Motor Company, of New York.

E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Nov. 17, 1888.

Denver, Colo.

The Denver Electric Illuminating Company, of Denver, Colo., are increasing their plant by the addition of 70 arc lamps, Thomson-Houston system.

New Corporation.

The Hyde Park Electric Light and Power Company, Chicago, has received incorporation license; capital, $500,000; incorporators, Lester L. Hills, Henry Becker and Lewis H. Bisbee.

Electrical Supply Company.

The Electrical Supply Company tell me that their O. & U. bell is getting to be about as well known as their famous P. & B. wire. Large orders for these goods are being constantly received by the company.

To Have Incandescent Light.

The Van Depoele Electric Manufacturing Company have just contracted to light the Schmidt Bakery, located on Clybourne avenue, in this city, with their new incandescent system. Two hundred lights will be required.

A Heavy and Early Snow Storm.

Dispatches from Atchison, Kas., of Nov. 10, state that the heaviest snow storm known in that section in ten years was raging in that city. Trains were delayed, and the telegraph wires prostrated in all directions with the exception of one line to Kansas City. In Atchison over 200 telephone lines were broken and so tangled up with the electric light wires that the electric light works were compelled to suspend to prevent accidents.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@	$155	Iowa Union	$25@	$27
Central Union	47@	48	Michigan	81@	82
Chicago	338@	340	Missouri and Kansas	70@	71
Colorado	43@	46	Rocky Mountain Bell	41@	43
Cumberland	68@	70	Wisconsin	116@	118
Great Southern	34@	37			

The Recent Bell Telephone Decision.

Telephone people here are much interested in the recent dispatches from Washington stating that Justice Miller, of the Supreme Court, has rendered an opinion adverse to the Bell Telephone Company in the suit brought against it by the United States to set aside the Bell patents on the ground of fraud. The decision is thought by many to have an important bearing on the telephone claims of Prof. Elisha Gray, of Highland Park, in whose patents a large number of Chicago people are interested.

A Large Motor.

I was recently, through the courtesy of Mr. F. A. Sargent, superintendent of the Chicago Edison plant, shown the largest motor that has yet been placed in operation in Chicago. It is rated at about 25 h. p., although its maximum capacity is something more. It is of the Sprague pattern and is used to operate printing presses, etc., in the Rand & McNally building on Monroe street. The current is furnished from the Chicago Edison Company's incandescent circuit. I may add that the machine is running very smoothly.

Personal.

Walter K. Freeman and C. Kammeyer, of the National Electric Manufacturing Company, of Eau Claire, Wis., were in the city during the past week looking after some business matters of their company. This company, which was recently organized, will soon bring out a new system of electric lighting. The company is well backed, and will shortly construct a factory at Eau Claire. Mr. Freeman occupies the position of electrician and general manager of the company, and Mr. Kammeyer that of superintendent of construction. These gentlemen were formerly connected with the Fort Wayne Jenney Electric Light Company, and their many friends will wish them success in their new enterprise.

The North Side Water-Works.

Professor Barrett says with reference to the North Side Water-Works plant that, "From the water-works we have run a 2,000-foot cable to the new inlet crib-house. In the house is a system of reflectors and twenty-four 32 candle-power lamps. Then we rigged up a quarter horse-power motor on the same cable and geared it so that it strikes a large fog-bell eight blows a minute. At the water-works, by a turn of a switch, the bell can be set going, and by another switch the electric lights can be lit. Sailors tell me that they can see this light long before they can see the one on the government pier. We have rigged up a repair shop in the power house, where in future the city can manufacture all the electrical appliances it needs."

The City Electric Light Plant.

Work on the new city electric light plant, I learn, is progressing nicely. It is expected to have the extension completed by Dec. 10, but it will not be in full operation until Christmas. As before noted in these columns, this plant will comprise all of the South Side to Van Buren street, West Madison street to Ashland avenue and all of the territory between Canal and Halsted and Madison and Van Buren streets, an area of one mile square. The original appropriation for this extension was $46,600, and all that amount has been expended with the exception of some $9,000. City Electrician Barrett claims that the engine in the City Hall is capable of running not only the present plant, but would run one that would cost $100,000 more than the present plant. It is thought that an additional appropriation of $100,000 will be asked for to further extend the system in the spring. Alderman Landon, Chairman of the Committee on Electric Lights, is reported as saying that there is no other possible way in which to break up the gigantic gas trust with which the city is being ridden to death. The people only need to see how much can be done with a small amount of money to be in favor of the extension of the system.

The Motor of the Future.

Mr. R. B. Martin is connected with one of the largest publishing and printing houses in the city. He has given considerable thought to the matter of running printing presses by motors, and has, I may say, some excellent ideas on the subject. In conversation a few days ago, Mr. Martin said he thought the day of the belt for transmitting power for that sort of service was done; that it was only a question of time when motors would be used exclusively for running light machines. The motor of the future, however, would, he thought, as used to operate printing presses, be attached directly to the machine. It would be reversible and under the complete control of the operator. By pressing a button with the foot the operator could stop or start the motor, and by means of a switch at the elbow the motor could be reversed.

Removal of the Hawkeye Company.

The Hawkeye Electric Manufacturing Company, formerly of Oskaloosa, Ia., are out with a neat folder announcing that the entire business of the company has been sold to the Hawkeye Electric Manufacturing Company, of Davenport, Ia., and that the entire plant will shortly be removed to Davenport. Their manufacturing facilities will be greatly increased, they having secured the extensive shops lately occupied by the Donahue Foundry and Machine Works. The authorized capital stock of the new company is $250,000, of which amount $50,000 is already paid in, and another $50,000 is subject to the call of the stockholders. The new company is said to have plenty of financial backing, and is made up of some of the most prominent business men of Davenport. The personnel of the company is as follows: President, M. L. Marks; secretary, Walter Chambers; directors, M. L. Marks, Walter Chambers, L. P. Best, Jens Loreson, Jas. Thompson, Jas. P. Donahue, E. P. Lynch; general manager, Wm. Bowen, formerly with the old company; electrician, Frank Thone, electrician of the former company. Mr. Bowen is well known to the electrical fraternity, having had many years' experience in that field, and it goes without saying that he will push the interests of the new company in his usual energetic way. The company announce that they shall aim to have the leading electrical factory in the West.

The Chicago Telephone Company.

A communication from the Chicago Telephone Company was submitted by the Mayor at the Council meeting last Monday evening with the recommendation that it be printed and referred to the Finance Committee, so that the officers of the company might be heard in support of its statements and arguments. The communication reads as follows:

CHICAGO, Nov. 12—*To the Honorable Mayor and City Council of Chicago*—GENTLEMEN: With the assent of the city of Chicago, expressed by permit, contract, ordinance, and acquiescence, the telephone company has erected in this city a system of telephones which is exceeded in number of subscribers by only one other in the world. To improve their service and to give the public the best telephonic convenience known to the art we have expended over $1,000,000. As a matter of fact, all of our construction has been made upon the streets of the city with the express consent and often under the direction of the officers of the city. Oct. 15 last the City Council passed an ordinance defining the rights of the Chicago Telephone Company, in which ordinance they inserted a provision that said Chicago Telephone Company shall not charge for the use of each telephone connected with its exchange more than $85 for each year subsequent to the first, and shall contract for three years' service with any one party at the rate of $75 per annum, which limitation prevents our acceptance of the ordinance. The present differences between the city and ourselves arose, we believe, on account of a misapprehension as to our rights in the city, the amount of free telephone service we render the city for these rights, and the fairness of the price we charge our patrons for the service rendered them, which misapprehensions we would like the opportunity to correct.

As to the first of these questions, we have already referred to our rights derived from the city. As to the second, the city has under its grants to the company the right to demand certain free telephone service. This right is conceded by us and the service given the city. After this engagement was entered into, one of your citizens invented and introduced what is known as the police patrol system, for which we voluntarily made a special arrangement with the American Bell Telephone Company whereby we have been enabled to rent you telephones for the use of the patrol system at a lower price than we furnish them to any other customer for similar service. Including the above rebate, with the exchange and private lines which we are furnishing the city without any charge, we are making a concession of over $10,000 per annum in excess of the requirements of your ordinance.

With reference to the fairness of our rates we submit a list of all the cities in this country which have a population of 200,000 or over, with their prices and subscribers, July 1, this year:

	Rate.	Subscribers.
New York	$150	7,218
Chicago	125	4,735
Boston	120	3,011
Philadelphia	120	2,888
Cincinnati	100	3,110
Baltimore	100	2,171
St. Louis (in litigation)	100	2,106
Pittsburgh	100	1,961
San Francisco	60*	2,706
Brooklyn	90	3,563
New Orleans	75	1,158

* And five cents for each talk.

In estimating the fairness of our charges to the public it seems to be generally forgotten that we pay more to a railroad to carry us 1,000 miles than 100; the grocer more for a barrel of sugar than a pound; more for an advertisement in a newspaper of 100,000 circulation and published daily than of 10,000 circulation with only a weekly edition. We say it seems to be generally forgotten, because we are denied an application of the same principles which govern in the cases above mentioned. It is, unquestionably, true that smaller places charge less per annum to

each subscriber than we do, but it is equally true that less is furnished, and that each service or "connection" costs more in those places than here. The average cost of our service to the subscriber last year in this city was a fraction under two cents per connection. The only other means of communication which approaches this in cheapness is the postal-card, where a brief question and answer may pass between two people for two cents, using at least twelve hours' time. If time is an essential element in the transaction the services of a special messenger are brought into use. That the telephone "distances" the latter in both price and speed will be readily admitted.

In the ordinance passed Oct. 15 the city undertakes to legislate upon the matter of rates to be charged by the telephone company, a subject which our counsel advise us is not covered by the city's charter, and that for that reason the ordinance is void. This company is not disposed to stand only on its legal rights, but is willing to make a fair adjustment of the differences between us, for which purpose we will be pleased to discuss the questions with any committee to whom you may refer the matter. It has been, and is, our policy and our endeavor to conduct the difficult business of this company honestly and with fairness to our subscribers. No effort or expense has been spared to secure the best mechanical devices, constructions, and operators. We submit, with due respect, that we know of no good reason why this interest should be singled out by the city and weighted with burdens imposed on no other corporate interest in Chicago. Respectfully, the Chicago Telephone Company, by George L. Phillips, president; Norman Williams, John De Koven, J. R. Jones, John B. Drake, John Crerar, directors.

Ald. Ernst, from the Committee on Licenses, reported the following resolution, which was adopted unanimously:

Resolved, That the City Law Department is hereby instructed to take such steps as may be necessary to have the injunction in the case of the Chicago Telephone Company vs. The City of Chicago dissolved, and that it is hereby directed to commence proceedings to test the authority of the Chicago Telephone Company to occupy and use the streets and alleys of the city of Chicago for telephone purposes.

Following these resolutions he presented an order directing the Commissioner of Public Works to prosecute the telephone and telegraph companies for having failed to place their wires under ground, as provided by the ordinance of 1883. The order was referred to the Committee on Fire and Water. E. L. P.

CANADIAN NOTES.

MONTREAL, Nov. 14, 1888.

The insulating department of the Royal Electric Company is running twenty-three hours a day, as the demand for their "Royal" line wire is taxing their facilities to their utmost. This wire has the approval of Mr. Badger, city electrician, and has received favorable comment from other competent judges.

The company also insulate all the magnet and armature wire used in the manufacture of their dynamos, lamps, etc.

The situation of Montreal on the River St. Lawrence, at the foot of the Lachine Rapids, is such that it is only a question of time when a portion of the enormous water-power will be utilized to furnish light, run the street cars, mills, elevators, etc., and, in fact, displace the use of steam power. Several schemes to this end have been projected, but so far have borne no fruit; but the following from the Montreal *Daily Witness* of Nov. 13 seems to give promise of future benefit:

A syndicate has purchased Ile au Heron, in the Lachine Rapids, from the Matthews' estate, to utilize the water-power for electric lighting in the city. The building of the necessary dams and bridges will be commenced immediately. The improvements, it is said, will cost about $500,000. The syndicate is composed of Mr. B. McLennan, Toronto; Mr. Jas. Conmee, of Port Arthur, representing other westerners; Mr. R. K. Thomas, representing a Montreal syndicate: Mr. James Leggatt, representing English capital, and Mr. M. D. Barr, representing a New York company.

ENGLISH NOTES.

LONDON, Oct. 31, 1888.

The Daily Press and the Deptford Station.

The members of the daily press were last week taken down to Deptford to see the progress which is being made with the station there, some details of which I gave in my last letter. The result has been that the papers have ever since been full of the most flaming descriptions of what is going to be done, and titles such as "The Resurrection of Electric Lighting," "The Light of the Future," and so on, have been displayed in all the dignity of roman capitals.

The Society of Telegraph Engineers.

A special general meeting of members of the Society of Telegraph Engineers is to be held on Nov. 8 to consider the question of changing the name of the society to "The Institution of Electrical Engineers." Should the resolution pass by the requisite majority, the matter will be submitted for confirmation to a second special general meeting of members on Nov. 22. That the title will be changed there can be but little doubt, for out of 846 replies to the circulars sent out, 837 expressed approval of the scheme.

The Waring Cable Company.

The Waring Electric Cable Company, who, I believe, are well-known on your side of the water under a slightly different name, have recently opened an office at 85 Queen street, London, and appear to mean business. Hitherto the trade in lead-covered cable in this country has been chiefly in the hands of a German firm, Messrs. Felten & Guillaume, of Mülheim-on-Rhine. They supply excellent cables, but as the insulation mainly consists of resin, they are not reliable where extremes of temperature are likely to be met with. I understand that in this particular the Waring cable possesses virtues of a highly remarkable character.

The Maxim-Weston Electric Company.

On Saturday last the petition of Mr. Hugh Watt for the winding up of the Maxim-Weston Company came before Mr. Justice Chitty in the Chancery division. Mr. Hugh Watt's counsel said that the petitioner claimed to be a creditor of the company for the sum of nearly £800, and that he also had another claim for £900. Against these bona fide claims the new directors had now put forward mere bogus counter claims for £4,616 for the purpose of preventing a winding-up order. After some discussion between the judge and the counsel on either side, it was agreed that the company should pay £500 within a fortnight into a bank in joint names, and that the petition should be dismissed when the money had been paid in; the final destination of this sum of money to depend on the result of a fresh action on other issues to be brought on by Mr. Watt within a week of the dismissal of the petition.

The Bradford Lighting Station.

The foundation-stone of the Bradford Municipal Central Lighting Station, now in course of construction, was laid last Friday by Alderman Frederick Priestman. The mains are to be run underground in brick trenches, and the generating plant will for the present consist of three complete sets of boilers, engines and dynamos, each equal to 150 h. p. In the course of his speech, Alderman Priestman said that they expected to be ready for a start early next year, and had no intention at present of going in for street lighting. Alderman Priestman concluded by announcing that the question of electric meters was practically settled, for he knew of one which he believed was "absolutely correct," and "a gentleman in Bradford was engaged in making another, and there was every reason to believe it would be a success." It is to be feared, however, that the worthy Alderman has not made himself very closely acquainted with the history of invention in this direction, or he might possibly have felt less sanguine as to the Bradford originator.

The Edison-Swan United Electric Lighting Company.

The annual general meeting of the Edison-Swan United Electric Lighting Company was held on Tuesday last. The report showed a balance of £25,123 on the profit and loss account, after providing for depreciation and all other charges connected with the heavy adverse balance which was incurred during the early years of the company's existence. The value of the stock carried forward was £19,590, as compared with £12,868 at the same date on the previous year; nevertheless the increased value of the stock was only in the same ratio as the increase in the volume of business transacted. The chairman, therefore, was justified in stating that they could now consider themselves to be a money-earning concern, a state of things which is quite a novelty to the shareholders of this company. Unhappily, however, although they have earned £25,000, they are not in a position to profit immediately by it, and, in view of the pending litigation with the Anglo-American Brush corporation, there was no alternative but to hold the money in reserve until the final decision had been arrived at. It is anticipated that the appeal will come on before Christmas, so we shall not have long to wait before the future of the company is practically decided. At the same time, the chairman was probably right in thinking that, even if the recent judgment annuling the Edison patent is confirmed on appeal, that it will not involve the company in anything like a disaster. The business of the company is now so firmly established that they are undoubtedly to a very large extent independent of patent rights.

The Inaugural Conversazione of the Institute of Medical Electricity.

The directors of the Institute of Medical Electricity gave a very successful "conversazione" on Tuesday night at the rooms of the London Medical Society in Chandos street. This institute has been founded on a thoroughly sound basis, with the view of giving electro-medical treatment on scientific lines, and thus raising medical electricity out of the atmosphere of quackery and fraud which has so long surrounded it. Among the visitors and patrons of the institute are Sir Morell Mackenzie, Drs. J. A. Fleming, John Hopkinson and Silvanus Thompson, and Prof. D. E. Hughes. Large rooms have been fitted up in Regent street with a very complete set of electro-medical appliances, and it is to be hoped that the idea will be appreciated by the public. During the evening the Tainter-Bell graphophone was in operation, and excited, of course, considerable attention. Not the least interested of the spectators was Professor Ayrton, who amused himself for some time in initiating every one into the mysteries of this latest American importation. In another room the Woodhouse & Rawson Company made a fine display of various electro-medical appliances. As microbes and bacilli were also on view, the exhibits as well as the entertainment were a judicious blend of electricity and medicine. The chairman of the institute, Mr. Wm. Lant Carpenter, delivered a short address explaining the objects of the enterprise, and he was followed by Prof. Silvanus Thompson, with a lecture on "Old and New Views of Magnetism." The lecture was naturally of a very elementary character, but evidently interested the audience. Professor Thompson did not let slip this opportunity of rescuing the name of Dr. Gilbert from its unmerited partial oblivion. He expatiated at length upon his work, and asserted that he was the real founder of the Royal Society, the father of modern magnetic research, and entitled in the temple of fame to a higher niche than Bacon and one as high as that of Shakespeare himself. The process of historical rearrangement of reputations is thus evidently spreading into scientific circles. The "conversazione" was certainly of an original kind, and will doubtless do much to accustom us all to medical electricity, and thus further the objects of the Institute.

THE TELEGRAPH.

Alexandria, Va., proposes to have a fire-alarm system.

Florida.—A company is to build a telegraph line from Braiden Town to Tampa.

The Gardiner Fire Alarm.—The Gardiner Auxiliary Fire Alarm Company, of New York, has been incorporated by L. N. Downs and others with a capital stock of $3,000.

THE TELEPHONE.

Boston, Mass.—The Long Distance Telephone Company will soon open several handsome offices in Boston.

The Eureka Telephone.—The New York Eureka Telephone Company has been incorporated by T. W. Osborn and others with a capital stock of $5,000.

THE ELECTRIC LIGHT.

Great Falls, N. H., now has its electric light plant in operation.

Kalamazoo, Mich., received bids last week on a city electric light plant of 150 arc capacity.

Baltimore, Md.—The Richard Sauer Manufacturing Company, of Locust Point, are putting in a plant of 100 incandescent lights.

Galt, Can.—Mr. A. McAuslan, chairman of the Fire and Water Committee, wants to make a contract for 32 arc lights for city lighting.

Whitman, Mass.—The street lighting committee has been authorized to close a three years' contract with the Whitman Electric Light Company.

Du Bois, Pa.—W. C. Pentz, city clerk, can furnish details as to the bids wanted on a city electric light plant. The town has a population of 6,500.

Masts in New York City.—The big electric light masts in Union and Madison Squares are being taken down. Pole lights are now in use in both squares.

Kenosha, Wis.—The Kenosha Gas, Electric Light and Fuel Company has been incorporated by J. H. Kimball and others, with a capital stock of $50,000.

Laconia, N. H.—A new 125 h. p. engine will soon be added to the electric light plant at Laconia, N. H., as motive power, the water wheels now in use not being adequate for that purpose.

Cuba.—Cable dispatches from Cuba state that the company formed in this city and Havana for the purpose of lighting the latter place by electricity has been granted a franchise and various privileges by the Havana municipal authorities.

Tyler, Tex.—The Tyler Electric Light and Power Company, for whom a Westinghouse alternating plant was installed last May by the Marr Construction Company, have just given that company an order to double the capacity. The new apparatus will be in operation by Dec. 1.

Fort Wayne, Ind.—The Hill Clutch Works have just secured a contract from the Fort Wayne Jenney Electric Company for a complete power transmission plant to be put up in that city, according to designs furnished by the works. The plant is to be used for lighting the city.

The Globe Carbon Company, of Cleveland, O., report a very decided increase in their business. The demand is so urgent that they will put on a night shift at once, thus giving them a capacity of 1,000,000 carbons per month. It is worthy of note that the Cincinnati Exposition was lighted by Globe carbons.

Edison Patents in Canada.—A special dispatch from Ottawa of Nov. 12 says: The Royal Electric Company of Boston will apply to-morrow to the Minister of Agriculture for the invalidation of the Edison patents for incandescent electric lighting in Canada, held at present by the Edison Electric Light Company of Montreal. Associated with the petitioners are the Westinghouse Company and the United States Electric Lighting Company, of Pittsburgh, Pa. The cancellation of the patents is sought on the ground that Edison failed to comply with the Canadian patent regulations, which provide for the manufacture of the article in Canada two years after the patent is awarded. A large number of expert witnesses will give testimony. The Bell telephone patents were cancelled a few years ago for the same reason.

APPLICATIONS OF POWER.

Fort Worth, Tex.—Negotiations are going on for the construction of 4½ miles of electric road.

Davenport, Ia.—The Iowa Belding Motor and Power Company, of Davenport, has been formed by E. B. Hayard and others with a capital stock of $100,000.

Decatur, Ill.—The Decatur Electric Street Railway Company, of Chicago, Ill., has been incorporated by T. Martin and others, with a capital stock of $100,000.

Richmond, Va.—The Richmond & Seven Pines Railroad Company, previously operating a dummy railroad, contemplate ultimately operating their road by electricity.

Lykens Valley, Pa.—The report from the superintendent of the Lykens Valley mine is that both motors on the Schlesinger electric road there are working very satisfactorily. On Nov. 12, the second motor hauled out 234 loaded cars, representing a total work of 2,000 mile tons. An electric light circuit with 40 Bernstein series lamps has been added. The whole plant has been paid for.

The Elevated to Try Electricity.—The management of the Manhattan Railway Company has asked the Julien Electric Motor Company to supply estimates for the equipment of the Grand Central Branch of the Third avenue road with electric motors. Col. Hain, when asked the reason for making any change in the present system, replied that while in a sense the move was experimental he hoped it was progressive, and was certainly made with a desire to facilitate travel.

PERSONALS.

Mr. Frank J. Sprague delivered a very able and interesting lecture on the electrical transmission of power before the Franklin Institute, Philadelphia, on Nov. 12.

Mr. M. R. Kimball, of the Royal Electric Company, delivered a lecture on Nov. 5, before the Medico-Chirurgical Society of Montreal, on systems of electrical distribution. The lecture was illustrated by stereopticon and by demonstrations.

Mr. H. H. Humphreys, superintendent of the Buffalo Electric Light and Power Company, gave a lecture before the Buf-

falo Electrical Society, on Nov. 5, on "The Electric Motor." The lecture was very interesting and was well received.

MISCELLANEOUS NOTES.

St. John, N. B.—The Brownley Electrical Manufacturing Company has been formed, with a capital stock of $10,000.

Baltimore, Md., has a pole war, and it is stated that Mayor Latrobe has instructed the city solicitor to take action in the matter for the purpose of checking pole line construction.

BUSINESS NOTICES.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them, stating what you want.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Messrs. Clay & Torbensen, of Camden, N. J., are prepared to manufacture all kinds of meritorious articles, both electrical and mechanical, and place same on the market. They are agents for the Roberts-Brevoort Electric Co., of New York, and report increasing sales of the batteries of this company. Messrs. Clay & Torbensen are also sole manufacturers and general sales agents of the Copeland oil vapor burners, boilers and engines, and the Depuy electric protector, to be used on an electric circuit where there is danger of excess of current.

The Wainwright Manufacturing Company, of Medford, Mass., reports a large number of sales of its corrugated tube feed-water heaters during the past month, including a 300 h. p. plain coil to the Wilmington, Del., Electric Light Company, one 8 h. p. plain coil to J. Post, Jr. & Co., Boston, Mass., and one of 25 h. p. to the Excelsior Electric Company, of Summit, N. J. The total reaches no less than some 2,000 h. p.

Ide Engines.—The Foundry and Machine Department of the Harrisburg Car Manufacturing Company report sales as follows: Middletown, Del., Electric Light Company, 30 h. p. Ide engine, 60 h. p. boiler and Weitmyer furnace; Augusta National Exposition, 100 h. p. Ide engine; J. Post, Jr., & Co., one 50 h. p. Ide engine for the Hartford, Conn., Electric Light Company and one 17 × 14 compound engine for the Plymouth, Mass, Electric Light Company; two 150 h. p. Ide engines for the Reading, Pa., Electric Light Company; one 50 h. p. Ide, with 60 h. p. boiler and Weitmyer furnace for the Kingston, Pa., Electric Light Company.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED NOV. 13, 1888.

392,604. Combined Fire Alarm and Telephone Switch; G. C. Hale, A. Barrett and J. Zentner, Kansas City, Mo. Application filed June 27, 1888. By the use of a switch the line is transformed at will into a telephone or fire alarm circuit.

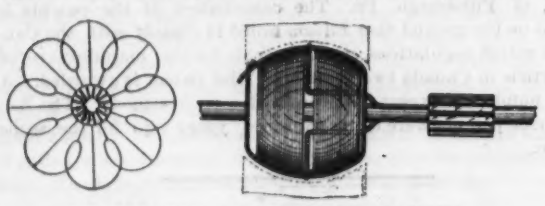
392,633. Electric Lamp Switch; Charles G. Perkins, Hartford, Conn. Application filed July 24, 1888. The improvements consist especially in providing means for preventing sparking, such means consisting of a pair of spring contacts supplemented by a third spring contact. The operation of the switch is such that the first two springs make the initial contact and receive the sparks, while the third spring is passed slowly into contact and makes good electrical connection. See illustration.

392,641. Auxiliary Fire-Alarm Box; E. L. Slocum, Lincoln, R. I. Application filed June 21, 1888. A tell tale or detector, which, as soon as the button sending the alarm is pressed drops from its place in the door and evidences that the box has been meddled with.

392,660. Insulation for Cores of Dynamo-Electric Machines; Benson Bidwell, Chicago, Ill. Application filed Oct. 17, 1887. The invention consists of sheets, spools, or tubes of thin metal shaped to fit the cores and parts of dynamo-electric machines and motors, and covered with substances which vitrify under the action of a proper degree of heat and form an enamel or glaze over their surface, so that the conducting wires may be wound thereon without further preparation or insulation.

392,664. Conduit for Electric Railways; Henry A. Chase, Stoneham, Mass. Application filed Dec. 21, 1887. A conduit having a longitudinal slot in its top at one side thereof, and a single division wall extending from the slot to the base of the conduit to form chambers, the wall being provided at intervals with openings to afford communication between the chambers.

392,665. Electric Gas Lighter; Henry A. Cleverly, Philadelphia, Pa. Application filed May 28, 1888. An electric gas lighter having a movable electrode adapted to be brought into contact with another electrode to create a spark, a lever for moving the first electrode, and devices for preventing contact between the two electrodes except at every alternate reciprocation of the first electrode.



392,765. DYNAMO ELECTRIC MACHINE.

392,666. Incandescent Lamp Socket; T. Coad, Forest Gate, England. Application filed Sept. 10, 1888. According to this invention a lamp can be hooked on or disconnected without the necessity of compressing a spring or the liability that now exists with the some forms of holders of frequently breaking the hooks of a lamp when fitting it in a holder.

392,675. Electric Railway; Rudolph M. Hunter, Philadelphia, Pa. Application filed Nov. 30, 1886. Details in the building of a car to facilitate the connecting up of the cells of battery arranged beneath the seats.

392,679. Electric Speed Governor for Water-Wheels; George M. Lee, Little Falls, New York. Application filed July 30, 1888. By the combined action of the centrifugal governors and electric circuits and magnets the speed of the water-wheel is controlled.

392,701. Electric Machine for Lighting and Extinguishing Gas; George E. Thaxter, Boston, Mass. Application filed Aug. 4, 1888. An electrical apparatus for lighting and extinguishing gas, consisting of a contact making and breaking device in the lighting and extinguishing circuit, an electro-magnet and mechanism connected therewith for actuating the movable member of the contact maker, the electro-magnet being in a circuit of its own, a double contact maker for closing simultaneously both circuits and clock mechanism for operating the double contact maker.

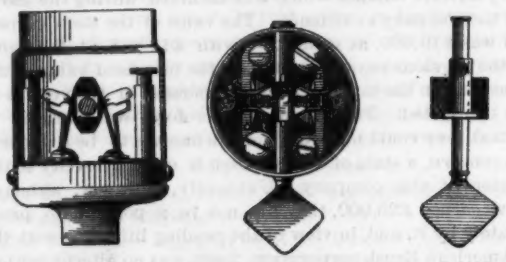
392,724. Electric Circuit and Apparatus Guard; I. H. Farnham, Malden, Assignor to the New England Telephone and Telegraph Company, of Boston, Mass. Application filed July 29, 1887. The invention consists in applying to the electro magnet of any electrical instrument an extra armature responding only to the passage of an abnormally strong current through the magnet coils and controlling a normally open shunt circuit arranged around the said magnet or around any number of instruments.

392,736. Electrical Apparatus for the Prevention of Incrustation; M. Kotyra, Cardiff, England, Assignor to C. Bulmand and A. B. Tiffen, of same place. Application filed June 2, 1888. Patented in England March 11, 1887, No. 3,749. The claim covers the combination of a battery or other apparatus for generating electricity, an electrode, boiler shell, and alternating apparatus.

392,757. Overhead Conductor for Electric Railways; Elias E. Ries, Baltimore, Md., Assignor by direct and mesne assignments to Ries and Henderson, of same place. Application filed Sept. 10, 1887. A line conductor extending parallel with the road and having pairs of contact surfaces, each contact surface of a pair facing each other. The contact trucks are mounted to engage with a pair of contact surfaces.

392,763. Mounting for Diaphragms for Acoustical Instruments; Charles S. Tainter, Washington, D. C. Application filed May 31, 1888. The diaphragm, according to this invention, is clamped between two thin metal washers, grooved or struck up, so as to present a bearing edge for contact with the diaphragm, the shape of the washers giving them slight elasticity.

392,765. Dynamo-Electric Machine; Elihu Thomson, Lynn, Mass. Application filed July 26, 1886. The invention consists, essentially, in making two or more joints or connections to each turn or length of armature conductor, the joints or connections being carried, respectively, to different segments of the commutator. See illustration.



392,633. ELECTRIC LAMP SWITCH.

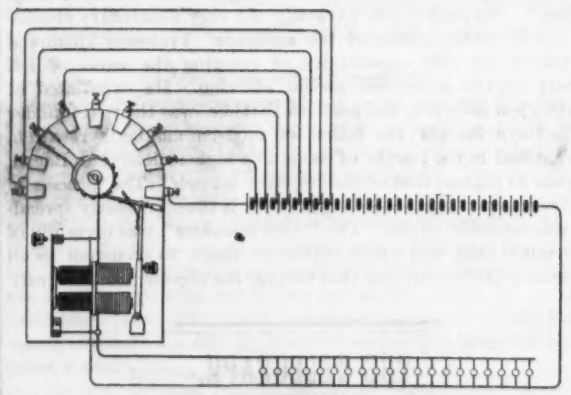
392,766. Signaling Apparatus; Wesley Trafford, New York, N. Y., Assignor by mesne assignments to Elizabeth R. Trafford, same place. Application filed March 28, 1887. The first claim is as follows: The combination, with an electric circuit, of a circuit-closing apparatus operated by a time mechanism, a plurality of signaling apparatuses, each controlled by an electro-magnet located in a loop connected to said circuit, and a switch for each loop, whereby any one or more of said electro-magnetsmay be put into or out of said circuit, substantially as described.

392,772. Electrical Railway; Orren Allen, Denver, Colo. Application filed Nov. 4, 1887. Current shunting devices are arranged in boxes adjacent to the continuous conductor. These devices are operated by the vehicle to shunt the current through the motor thereon.

392,775. Electric Circuits; John A. Barrett, Brooklyn, New York, Assignor to the American Telephone and Telegraph Company, of New York. Application filed May 9, 1888. A group of metallic circuits supported on poles, each two circuits immediately adjacent in any direction, horizontally, vertically, or diagonally, being made inductively neutral to each other by causing the direct and return wires of them to cross or exchange places in such a manner that the average distance of each wire of the crossed circuit from the two wires of the other shall be the same. See illustration.

392,810. Mechanical Telephone; L. Mellett, Newton, Mass. Assignor to the Pulsion Telephone Company, of Concord, N. H. Application filed Aug. 28, 1888. A shell having a chamber therein, a diaphragm, a line wire connected to the diaphragm, and a vibrator located in the chamber.

392,826. Automatic Switch for Secondary Batteries; John S. Sellon, Hatton Gardens, England, Assignor to the Electrical Accumulator Company, of New York. Application filed Aug. 30, 1887. Patented in England, Jan. 13, 1883, No. 217; in France, June 29, 1883, No. 156,156; and in Germany, July 17, 1883, No. 27,868. The invention consists of an electro-magnetic or other suitably constructed switch, which can be actuated by the outgoing current when such current falls below a given E. M. F., so as to cause the magnet or magnets to switch in one or more accumulators from time to time as may be required for the purpose of maintaining a constant or practically constant E. M. F. See illustration.



392,826. AUTOMATIC SWITCH FOR SECONDARY BATTERIES.

392,832. Individual Signaling Apparatus; Charles N. Talbot, New York, N. Y. Application filed July 19, 1888. The invention is intended to be used in connection with police signaling systems as a means whereby the attention of any policeman can be attracted from the police station, so that he may know that the station desires to communicate with him and may proceed to his telephone box and call up the station.

392,836. Carbon Battery; John B. Wallace, Ansonia, Conn., Assignor to the Electrical Supply Company, of same place. Application filed Sept. 3, 1888. A cap for carbon batteries having recesses formed upon the under side to receive the ends of the carbon, combined with a set screw from the outside radially into the said recesses, and the said recesses constructed with two or more bearing points upon their inside opposing said screw, and whereby the carbon may be clamped between the bearing points and the said screw as a means for supporting the carbons in the cap and a good electrical contact insured.

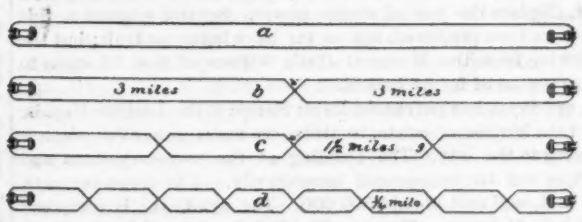
392,838. Message and Time Recorder; John C. Wilson, Boston, Mass. Application filed Jan. 25, 1887. The invention consists in combining with a message recorder, comprising registering mechanism and paper moving mechanism, a time stamp consisting of a dial and indicating hands or pointers, and means for actuating the hand stamp automatically to print the time upon the strip.

392,843. Telephone Support; S. Bergmann, New York, N. Y., Assignor to the American Bell Telephone Company, of Massachusetts. Application filed Sept. 25, 1885. A telephone containing a body of mobile material and a vertically swinging arm upon which said telephone is pivoted above the centre of gravity.

392,855. Automatic Governor for Dynamos; E. B. Coburn, Walpole, Mass. Application filed April 27, 1888. The shaft of the dynamo is geared to a constantly rotating shaft through a series of conical rollers. The conical rollers are arranged in two pairs, one pair to drive the other through an intermediate cylindrical roller. The position of the cylindrical roller laterally determines the speed of the pair of rollers, and consequently of the dynamo shaft.

392,863. Electric Railway; Benjamin Heywood, New York, N. Y. Application filed July 24, 1888. The conductor is housed within a hollow rail, and the current collector impinges against it by entering the side of the rail.

392,890. Regulation of Electric Motors; William Stanley, Jr., Great Barrington, Mass., Assignor to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed May 13, 1887. The invention consists in a novel method of increasing and decreasing the development of energy from an electric motor in accordance with, and proportionately to, variations in the work or load imposed by automatically decreasing and increasing the electro-magnetic effect of a demagnetizing circuit upon the field of the machine.



392,775. ELECTRIC CIRCUIT.

392,914. Telegraphy; S. D. Field, Stockbridge, Mass. Application filed Aug. 24, 1888. Claim 1 is as follows: In a system of telegraphy, a transmitting apparatus comprising, in combination with a line and earth, the armatures of three shunt-wound dynamo electric generators, two continuity preserving keys located between said armatures and the line, and fixed resistances located between each of said armatures and earth, whereby said armatures are adapted, two of them, to send impulses, independently or jointly, and the third independently only.

392, (1) 392,930. (2) 392,967. Methods of Synchronizing Electric Motors; Francis J. Patten, New York, N. Y., Assignor of (2) to J. M. Seymour, New York, N. Y. Applications filed respectively June 1, and Oct. 16, 1888. The invention consists in a method of establishing synchronous motion of the rotating parts of two or more electric motors by providing each of the motors with independent field magnet and armature circuits and causing simultaneously in one of these independent circuits of each motor reversals of current, and in causing a direct current to flow through the other independent circuit of each of the motors.

392,970. Annunciator; Foster Ritchie, Chicago, Ill., Assignor to the Railway Car Telegraph Supply Company, of same place. Application filed April 25, 1887. The prime object of the invention is to simplify the construction of the annunciator by utilizing, in connection with the flexible, but otherwise fixed, armature a hollow core of a magnetic coil as a bearing for a spindle, to one end of which is secured the index hand, and to the opposite end of which is secured the gravitating or weighted lever for causing a partial rotation of said hand.

392,971. Electric Railway; Ira Robbins, of Camden, N. J., Assignor of one-half to Wm. Nuneviller, Philadelphia, Pa. Application filed May 26, 1888. A conduit for electric railways having a conductor inclosed in a channel in its upper surface, and to one side of the centre thereof, said conduit being embedded in wooden blocks.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.